

IARCSAS 2023

III. INTERNATIONAL ARCHITECTURAL SCIENCES & APPLICATIONS SYMPOSIUM

September 14-15, 2023 / Naples-Italy
The University of Naples Federico II
Online and Face to Face

PROCEEDINGS BOOK

Editors:

Prof. Dr. Atila GÜL

Prof. Dr. Öner DEMİREL

Assoc. Prof. Dr. Seyithan SEYDOŞOĞLU

Dr. Floriana ZUCARO

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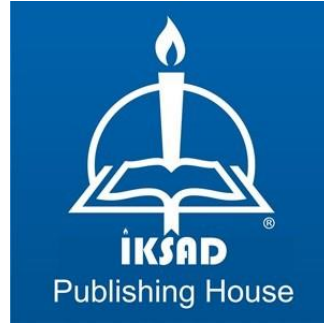
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For More Details

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**III. INTERNATIONAL ARCHITECTURAL SCIENCES
AND APPLICATIONS SYMPOSIUM**

(IArcSAS-2023)

September 14-15, 2023, Naples, Italy

PROCEEDINGS BOOK
(Abstracts & Full Papers)

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“SYMPOSIUM ID”

CONFERENCE TITLE

III. International Architectural Sciences and Applications Symposium,
(IArcSAS-2023)

DATE and PLACE

September 14-15, 2023
The University of Naples Federico II, the Engineering Building at Piazzale Tecchio,
80 - 80100 Naples. Italy.

ORGANIZING



The Editorial Board of the Journal of Architectural Sciences and Applications, Isparta, Türkiye.
(<https://dergipark.org.tr/en/pub/mbud>)



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AIMS OF THE SYMPOSIUM

This Symposium aims to bring together qualified scientists from Türkiye and abroad on a common international platform under the umbrella of “Architectural Sciences” and to enable “different disciplines” to share their valuable research.

TOPICS OF THE SYMPOSIUM

- Planning (Planning theories, planning paradigms, types of planning, regional planning, watershed planning, landscape planning, urban planning, rural planning, planning and protection, spatial and temporal changes, site selection methods, etc.),
- Design (Design Theories, Space, Building, Urban, Landscape, Rural, Village, Tourism, Recreational, Environment, Interior Architecture, Plantation, Industrial Products, Ecological, Universal, Disabled, etc.),
- Sociology / Psychology / Art / Philosophy / History / Identity / Theory / Aesthetics,
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- Smart and Ecological Cities / Urbanizm / Landscape / Open and Green Spaces / Green infrastructure / Transportation / Urban Agriculture / Urban Renewal / Transformation,
- Building Materials / Green Buildings / Urban Accessories and Furniture / Landscape materials/ Landscape Plant Materials and Using/ Plant Cultivation and Use,
- Technology / Artificial Intelligence / Digital Architecture and 3D Software and Printer, GIS, Remote sensing,
- Health / Pandemic / Food / Occupational Health and Safety,
- Higher Education in Architectural Sciences / R&D / Scientific Researches / Publications,
- Future of Architectural Sciences / Utopia / Space Architecture / Water Architecture,
- Economic / Policies / Legislation / Management / Governance / Practices / Sectoral Problems,
- Planning and Design Project Competitions and Processes /Applied Project, etc.

PRESENTATION

Oral and Online Presentations

EVALUATION PROCESS and POLICIES

All applications have undergone double blind peer review process. In addition, each paper was accepted and the process of publishing in the book was carried out through editorial oversight. The published papers were presented and discussed at the meeting.

Full texts and abstracts published in accordance with the Symposium Policy have been prepared in accordance with ethical rules and APA standards. Authors of all papers are both ethically and legally responsible.

PARTICIPANTS COUNTRIES

Türkiye, Turkish Republic of Northern Cyprus, Italy, Algeria, Brazil, Bulgaria, China, Ethiopia, Bangladesh, France, Greece, Georgia, Germany, Hungary, India, Iran, Kosovo, Macedonia, Malaysia, Morocco, Nigeria, Pakistan, Philippines, Poland, Romania, Russia, Spain, Ukraine, United Arab Emirates, United Kingdom, Vietnam.

TOTAL ACCEPTED ARTICLES: 364

Number of Rejected Papers: 35

The Number of Accepted Papers from Türkiye: 169

The Number of Accepted Full Papers from Other Countries: 187

The Number of Total:356



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**III. INTERNATIONAL ARCHITECTURAL
SCIENCES AND APPLICATIONS
SYMPOSIUM
(IArcSAS-2023)**

**September 14-15, 2023
Naples, Italy**

SYMPOSIUM SCHEDULE



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SYMPOSIUM SCHEDULE

		14.09.2023									
		10:00-11:30	Opening Speeches								
SESSION 1 (Invited Speakers)	11:30-12:45	HALL-1									
	Moderator	Elif Demirel									
SESSION 2 (Face to Face)	13:00-15:00	P.le Tecchio 80 (Napoli)									
	Moderator	Sebahat Sevede Sağlam									
SESSION 3	13:00-15:00	HALL-1	HALL-2	HALL-3	HALL-4	HALL-5	HALL-6				
	Moderators	Carmen Guida	Hayriye Hale Kozlu	Sevgi Yılmaz	Serkan Sipahi	Mert Çakır	Hani Benguesmia				
SESSION 4	15:15-17:15	HALL-1	HALL-2	HALL-3	HALL-4	HALL-5	HALL-6				
	Moderators	Mehmet Tuncer	Gerardo Carpentieri	Hasan Yılmaz	İsmail Emre Kavut	Nodar Sulashvili	Vaibhav Kant Singh				
SESSION 5	17:30-19:30	HALL-1	HALL-2	HALL-3	HALL-4	HALL-5	HALL-6				
	Moderators	Niyazi Uğur Koçkal	Ümit Turgay Arpacıoğlu	Mert Çakır	Floriana Zucaro	Halime Gözlükaya	Gizem Dinç				
SESSION 6	8:30-10:30	HALL-1	HALL-2	HALL-3	HALL-4	HALL-5	HALL-6				
	Moderators	H. Berk Türker	Bahia Messai	Tuba Gizem Aydoğan	Ahmet Erkan Metin	Mert Akoğlu	Orhan Alav				
SESSION 7	10:45-12:45	HALL-1	HALL-2	HALL-3	HALL-4	HALL-5	HALL-6				
	Moderators	Aybike Ayfer Karadağ	Lale Karataş	Asena Soyuluk	H. Berk Türker	Bogdan-Catalin Serban	Vaibhav Kant Singh				
SESSION 8	13:00-15:00	HALL-1	HALL-2	HALL-3	HALL-4	HALL-5	HALL-6				
	Moderators	Kağan Günce	Tendü Hilal Göktuğ	Şirin Gülcen Eren	Şevket Alp	Doğa Demirel	Nodar Sulashvili				
SESSION 9	15:15-17:15	HALL-1	HALL-2	HALL-3	HALL-4	HALL-5					
	Moderators	Şebnem Ertaş Beşir	Meryem Bihter Bingül Bulut	Ebru Doğan	Murat AKTEN	Bogdan-Catalin Serban					
SESSION 10	17:30-19:30	HALL-1	HALL-2	HALL-3	HALL-4	HALL-5					
	Moderators	Salih Ofloğlu	Demet Demiroğlu	Cengiz Yücedağ	Ertan Düzgüneş	Çağla Aydemir					



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Date: 14.09.2023

Ankara Time: 10:00 -11:30

Meeting ID: 833 1287 1999

Passcode: 030303

OPENING SPEECHES

Announcer: Atabek Movlyanov

<u>SPEAKERS</u>	<u>AFFILIATION</u>
1 Atila Gül	President of the Organizing Board (IArcSAS-2023) and Chief Editor, <i>Journal of Architectural Sciences and Applications</i> , Türkiye
2 Mustafa Latif Emek	President of the Economic Development and Social Research Association (IKSAD), Türkiye
3 Romano Fistola	Universita Degli Studi Di Napoli Federico II, Italy
4 Floriana Zucaro	Assistant Professor at TeMALab, Italy
5 Öner Demirel	Kırıkkale University, School of Fine Arts, Department of Landscape Architecture (Türkiye)



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INVITED PRESENTATIONS

THURSDAY 14.09.2023
Ankara Time 11:30-12:45

SESSION-1, HALL-1 / OTURUM-1, SALON-1
MODERATOR: Elif DEMIREL

Invited Speakers



Prof. Valerio Cutini

Assoc. Prof. Ebru Doğan

Prof. Hakan Alphan

University of Pisa
Urban Planning (Italy)

Malatya Turgut Özal University,
Faculty of Architecture, Department
of Architecture (Türkiye)

Çukurova University
Faculty of Architecture,
Department of Landscape
Architecture (Türkiye)

**"The Weak Ties That Bind
a City"**

**"Earthquake-Resilient Structures
and Sustainable Urban
Transformation"**

**"Three-Dimensional
Representation of Landscapes
and Modelling Potential
Visibility"**

11:30-11:55

11:55-12:20

12:20-12:45



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THURSDAY - 14.09.2023		
Ankara Time 13:00-15:00		
(Face to Face) P. le Tecchio 80 (Napoli)		
IN PERSON SESSION-2 / YÜZ-YÜZE OTURUM-2		
MODERATOR: Sebahat Sevde Sağlam		
TITLE	AUTHORS	AFFILIATION
An Experimental Study to Improve the Matrix of the Earthen Materials	<ul style="list-style-type: none">• Nazife Özer• Sebahat Sevde Sağlam• Seden Acun Özgünler	Istanbul Technical University (Türkiye)
An Experimental Study on The Production of Mycelium-Based Biocomposites	<ul style="list-style-type: none">• Sebahat Sevde Sağlam• Nazife Özer• Seden Acun Özgünler	Istanbul Technical University (Türkiye)
Refunctioning for Sustainable Cultural Heritage: "Cenani Mansion" Interior Design Workshop	<ul style="list-style-type: none">• Ebru Yazgan Serinkaya	Gaziantep University (Türkiye)



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THURSDAY - 14.09.2023 Ankara Time 13:00-15:00		
SESSION-3, HALL-1 / OTURUM-3, SALON-1 MODERATOR: Carmen Guida		
TITLE	AUTHORS	AFFILIATION
The Potential of Urban Open Spaces When Coping with Climate Change Effects	<ul style="list-style-type: none"> • Carmela Gargiulo • Floriana Zucaro 	University of Naples Federico II (Italy)
Naturalness and Naturalization Studies for Livable Cities	<ul style="list-style-type: none"> • Öner Demirel • Meryem Bihter Bingül Bulut • Tuğba Üstün Topal 	Kırıkkale University (Türkiye)
Insights for an Urban Infill Architectural Concept: The Case of Chueca Madrid	<ul style="list-style-type: none"> • Mira Naif Haddad 	IE University (Spain)
Regional Environmental Safety and Artificial Woody Plantings Introduced in the Dnieper Steppe (Ukraine)	<ul style="list-style-type: none"> • Maksim O. Kvitko • Olena A. Lykholat • Tetyana Y. Lykholat • Yuriy V. Lykholat 	Kryvyi Rih State Pedagogical University (Spain)
Impact of Urban Expansion on Urban Heat: A Case Study of Greater London	<ul style="list-style-type: none"> • Semudara, Oluwaseun Moses • Onibaba Paul O. • Ayomide Samuel Famewo 	Sheffield Hallam University (Ukraine)
The Smart Cities of the Future	<ul style="list-style-type: none"> • Teodora Rizova 	New Bulgarian University (Bulgaria)
Smart Cities and Sustainability in the Modern Era: Evidence From Saint Petersburg, Russia	<ul style="list-style-type: none"> • Ehsan Rasoulinezhad 	University of Tehran (Iran)
The Efficacy of Internet of Things (Iot) Based Intelligence on Smart City System Architecture	<ul style="list-style-type: none"> • Moses Adeolu AGOI • Solomon Abraham UKPANAHAH • Oluwanifemi Opeyemi AGOI 	Lagos State University of Education (Pakistan)



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THURSDAY - 14.09.2023 Ankara Time 13:00-15:00		
SESSION-3, HALL-2 / OTURUM-3, SALON-2 MODERATOR: Hayriye Hale Kozlu		
TITLE	AUTHORS	AFFILIATION
Westernization Period in Istanbul: Ottoman Dynasty Tombs, Architectural Style and Pearlescent Cistern Fences	<ul style="list-style-type: none">• Ataberk Tümel• Hüseyin Cengiz	Istanbul Ticaret University (Türkiye)
Investigation of Konya Karatay Madrasah Built in Anatolian Seljuks in the Context of Biophilic Design Criterias	<ul style="list-style-type: none">• Selin Kılıç Dede• Burcu İncir	KTO Karatay University (Türkiye)
The Analysis of Stadium 974 Structure in the Context of Sustainable Architecture	<ul style="list-style-type: none">• Yağmur Yılmaz• Gökhan Uşma	Adana Alparslan Türkeş Science and Technology University (Türkiye)
Living in Space: The Quest to Produce Habitats on Different Planets and the Role of 3D Printing Technology	<ul style="list-style-type: none">• Mustafa Haki Eraslan• Ömer Özeren	Karabük University (Türkiye)
Impact of Different Entrances on Microbial Quality and Pathogen Distribution in Houses	<ul style="list-style-type: none">• Halit Coza• Mahmed Sari Njjar	Pamukkale University (Türkiye)
Energy-Efficient Retrofitting and Cost Analysis of Existing Buildings Through Enerphit Standard: Yenişehir Worker Housing	<ul style="list-style-type: none">• Havva Koca• Merve Tuna Kayılı	Karabuk University (Türkiye)
Perception to Reality: A Study on The Perceptions of Architects and Civil Engineers Before and After They Stepped into Their Careers and Professions	<ul style="list-style-type: none">• Miel Ryan M. Alavanza• Abigail P. Ebreo• Mary Princess F. Alagna• Jerrell Cedric S.T. Flores• Cristine Jewel S. Almojera• Rajeev C. Pradeep Kumar• Skyler James M. Catapang• Justine Shin R. Reyes• Cyron Marie C. Delos Santos• Elyza B. Samonte	Lorma Colleges Senior Highschool (Philippines)
Green Building for Urban Sustainable Development	<ul style="list-style-type: none">• Elena Sierikova• Serhii Ivanov	National University of Civil Protection of Ukraine (Ukraine)



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Ankara Time 13:00-15:00		
SESSION 3, HALL-3 / OTURUM-3, SALON-3		
MODERATOR: Sevgi Yılmaz		
TITLE	AUTHORS	AFFILIATION
The Effect of Green Areas on Thermal Comfort in Cold Climate Regions: The Case of Ata Botanic Garden	<ul style="list-style-type: none">• Mehmet Akif Irmak• Sevgi Yılmaz	Ataturk University (Türkiye)
Outdoor Thermal Comfort Analysis for New Settlements in Cold Climate Regions: The Case of Erzurum	<ul style="list-style-type: none">• Sevgi Yılmaz• Mehmet Akif Irmak	Ataturk University (Türkiye)
Through Current Use Cases of Family Health Centers Evaluation	<ul style="list-style-type: none">• Yağmur Kocabıyık Amasyalı	Maltepe University (Türkiye)
Rainfall Recycling: Innovative Approaches for Sustainable Water Management in Urban Areas	<ul style="list-style-type: none">• Ayşe Gülnur Gül• Murat Akten	Süleyman Demirel University (Türkiye)
Assessment of the Effects of Urbanization on Green Spaces and Land Surface Temperature: A Case Study of Esenyurt, İstanbul	<ul style="list-style-type: none">• Tuğba Üstün Topal• Meryem Bihter Bingül Bulut• Öner Demirel	Tekirdağ Namık Kemal University (Türkiye)
Analyzing the Effects of Urban Sustainability Assessment Tools on City Branding: The Case of LEED, BREEAM, YES-TR	<ul style="list-style-type: none">• Ash İlayda Koçak• Murat Akten	Süleyman Demirel University (Türkiye)
Background of The Processes of Combating Climate Change of Local Governments in the Scope of Urban Planning	<ul style="list-style-type: none">• Mevlit Kürşat Ateş• Mediha Burcu Sılaydın	Dokuz Eylül University (Türkiye)
Benchmarking of 3D Printed Concrete With Selected Building Materials in Terms of Energy Efficiency and Carbon Emissions	<ul style="list-style-type: none">• Ebru Kılıç Bakırhan• Semahat Merve Top	Karabuk University (Türkiye)



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Ankara Time 13:00-15:00		
SESSION-3, HALL-4 / OTURUM-3, SALON-4		
MODERATOR: Serkan Sipahi		
TITLE	AUTHORS	AFFILIATION
The Impact of the Pandemic on Interior Design: Lessons Learned	<ul style="list-style-type: none">• Masoumeh Khanzadeh	Nuh Naci Yazgan University (Türkiye)
Art as Inspiration in Interior Space	<ul style="list-style-type: none">• Ceren Koç Sağlam• Müge Goker Paktas	Marmara University (Türkiye)
Searching Boundaries of Interior Architecture Education in the Context of Knowledge Area and Professional Field	<ul style="list-style-type: none">• Timuçin Erkan• Müge Göker Paktas	Marmara University (Türkiye)
Re-Functioning Within the Scope of Conservation Awareness in Interior Architecture Education: The Case of Paşalimanı Flour Factory	<ul style="list-style-type: none">• Neşe Başak Yurttaş• Tuba Terece	Biruni University (Türkiye)
Production of Post-Disaster Interior Scenarios	<ul style="list-style-type: none">• Sabiha Sevgi• Beyza Nur Bozkurt Gündüz	Biruni University (Türkiye)
Sustainability of Seating Elements Within the Scope of Urban Furnitures, Rize Example	<ul style="list-style-type: none">• Serkan Sipahi• Merve Sipahi	Ataturk University (Türkiye)
Development of Facade Design in Traditional Konya Houses	<ul style="list-style-type: none">• Burcu İncir• Gamze Tekin	KTO Karatay University (Türkiye)
Altitude of Households Towards Waste Management Practices in Urban Slums of Ibadan Metropolis, Oyo State, Nigeria	<ul style="list-style-type: none">• Olawale Julius Aluko• Julianah Omotola Ogunsola• Folashade Ojo-Fakuade• Adebayo Samson Adeoye	Federal College of Forestry (Nigeria)



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THURSDAY - 14.09.2023 Ankara Time 13:00-15:00		
SESSION-3, HALL-5 / OTURUM-3, SALON-5 MODERATOR: Mert Çakır		
TITLE	AUTHORS	AFFILIATION
Note on Translated Sum on Primitive Sequences	<ul style="list-style-type: none"> • N. Rezzoug • I. Laib 	Tiaret University (Algeria)
The Different Types of Mesoporous Materials	<ul style="list-style-type: none"> • Boughedir Nadia • Bailiche Zohra 	Université de Tlemcen (Algeria)
The Assessment of FIAT Competitiveness in the European Electric Vehicle Market (Year 2022)	<ul style="list-style-type: none"> • Boukhedimi Chems Eddine 	University of Tizi Ouzou (Algeria)
Diatomite its Characterization, Thermal Modification, and Application: A Review	<ul style="list-style-type: none"> • Hanane Ait Hmeid 	Mohammed First University (Algeria)
The Production of Electrical Energy by the Different Types of Polluting and Renewable Energy	<ul style="list-style-type: none"> • Farida Khammar • Naoual Handel • Sarah Djouimaa 	University of Souk Ahras (India)
Development of Standard Electrical Apparatus For Determination of Acceleration Due to Gravity Amongst Undergraduates Physics Students in Niger State, Nigeria	<ul style="list-style-type: none"> • Muhammed Saifullahi • Bunkure Y. I. 	Federal University of Technology (Nigeria)
Electromagnetic Absorber	<ul style="list-style-type: none"> • Sahana S • Vishali C • Thana Lakshmi 	R.M.K. Engineering College (Algeria)
A Review of Economic Importance and Viability of Gold: A Case Study of Ilesha Schist Belt, Southwestern Nigeria	<ul style="list-style-type: none"> • Ahmed K. Usman • Saidat O. Abdurashed • Yusuf A. Hassan • Echeche Onuh • Yahaya Aliyu 	Ahmadu Bello University (Algeria)



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SESSION-3, HALL-6/OTURUM-3, SALON-6 MODERATOR: Hani Benguesmia		
TITLE	AUTHORS	AFFILIATION
Investigation of High Voltage Cap and Pin Insulators Performance Under Different Pollution Conditions	<ul style="list-style-type: none"> • Oussama Ghermoul • Hani Benguesmia • Loutfi Benyettou 	University of M'sila (Algeria)
Control Algorithms of Shunt Active Power Filter for Harmonics Mitigation in a Four-Wire Distribution Network	<ul style="list-style-type: none"> • Hani Benguesmia • Badis Bakri • Nassima M'ziou 	University of M'sila (Algeria)
Role of Brand Experience in Building Consumer Loyalty – A Conceptual Study	<ul style="list-style-type: none"> • Manita Arora 	Amity University (Algeria)
Study of Electric Field Distribution on Insulators Using Finite Element Method	<ul style="list-style-type: none"> • Hani Benguesmia • Bais Bakri • Nassima M'ziou 	University of M'sila (Algeria)
Numerical Simulation of The Electric Field and The Potential Distributions in Heterogeneous Cavities in High Voltage Cables	<ul style="list-style-type: none"> • Hani Benguesmia • Bais Bakri 	University of M'sila (Algeria)
Mutual Wetting Capabilities of Oil-Water: Polymer: Rock In Some Oil Fields in Albania	<ul style="list-style-type: none"> • Lorina Liçi • Ardit Mihali 	Polytechnic University of Tirana (Algeria)
Challenges Facing the Adoption of New Public Management Strategies in the Nigerian Local Governments	<ul style="list-style-type: none"> • Wasiu Abiodun Makinde 	The Federal Polytechnic (Nigeria)
Geopolitical Importance of Afghanistan for China	<ul style="list-style-type: none"> • Jamaluddin Sadruddin Oghli 	Eurasia Strategic Research Center (Nigeria)



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THURSDAY - 14.09.2023 Ankara Time 15:15-17:15		
SESSION-4, HALL-1 /OTURUM-4 SALON-1 MODERATOR: Mehmet Tunçer		
TITLE	AUTHORS	AFFILIATION
Protecting The City of Culture, Art and Science Pergamon (Bergama) Case: Zeus Altar	<ul style="list-style-type: none">• İrem Yurday• Mehmet Tunçer	Konya Technical University (Türkiye)
An Investigation of Rural Morphology in Planned Settlement Villages with Fractal Analysis Method: The Case of Böğrüdelik	<ul style="list-style-type: none">• Ayşe Tüzün Güner• Gülnihal Uğur	KTO Karatay University (Türkiye)
Examining the Influence of Religion on Place Attachment Through the Shack Movie	<ul style="list-style-type: none">• Gülnihal Uğur• Ayşen Özkan	KTO Karatay University (Türkiye)
Factors Influencing Consumers' Preferences for Sustainable Transportation– A Conceptual Study	<ul style="list-style-type: none">• Manita Arora	Amity University (India)
Development of User-Ecosystem Sensitive Proposals for Sustainable Land Use Planning in Beykoz and Hıdiv Pavilion Groves	<ul style="list-style-type: none">• Melih Öztürk• Ahmed Cemal Çakmak	Bartın University (Türkiye)
Promoting Cultural Heritage for Social Sustainability: An Examination of a Public Awareness Campaign in an Urban Setting	<ul style="list-style-type: none">• Ece Kumkale Açıkgöz• Ayşe Gülce Karakaya	Ankara Science University (Türkiye)
Analysis of the Morphological of Hamamyolu Çarşısı	<ul style="list-style-type: none">• Özlem Büyüктаş	Adana Alparslan Türkeş Bilim ve Teknoloji University (Türkiye)
Process Management Analysis in Urban Transformation Projects within Scope of 6306 laws in Türkiye: The Case of İstanbul Bakırköy	<ul style="list-style-type: none">• Elif Çileli Umuç	İstanbul Kültür University (Türkiye)



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SESSION-4, HALL-2/OTURUM-4, SALON-2 MODERATOR: Gerardo Carpentieri		
TITLE	AUTHORS	AFFILIATION
Smart, Green, Ecological & Sustainable Cities: The Scientific Meeting Point	<ul style="list-style-type: none"> Ismail Olaniyi Muraina 	Lagos State University of Education (Nigeria)
Initiative of Smart & Ecological City Around the World as a Process of Global Change	<ul style="list-style-type: none"> Ananda Majumdar 	University of Alberta (Italy)
The Importance of Green Infrastructure in the Qualities of Cities and Urban Life	<ul style="list-style-type: none"> Azadeh Rezafar 	Istanbul Arel University (Türkiye)
Water Management in Communes in Poland	<ul style="list-style-type: none"> Zbigniew Grzymała Agnieszka Wójcik-Czerniawska 	SGH-Warsaw School of Economics (Poland)
Phenomenology of the Palestinian Village Dwelling	<ul style="list-style-type: none"> Abdurrahman Mohamed 	Antalya Bilim University (Türkiye)
Risks Perception of Public Transportation Systems During Public Health Emergencies; A Case Study of Pre- and Post-Covid-19 Era in Nigeria	<ul style="list-style-type: none"> Ayomide Samuel Famewo Kolade Victor Otokiti 	University of Ibadan (Algeria)
The Applications of Sustainable Tourism and Interventions for the Preservation of the Archeology and Heritage of Hisban	<ul style="list-style-type: none"> Mohammad Ghosheh Leen Fakhoury 	German Jordanian University (Iran)
Prospects for the Use of Aerial Ropeways for the Organization of Sustainable Public Transport in Smart Cities	<ul style="list-style-type: none"> Alexander Lagerev Igor Lagerev 	Academician I G Petrovskii Bryansk State University (Russia)



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SESSION-4, HALL-3 / OTURUM-4, SALON-3 MODERATOR: Hasan Yılmaz		
TITLE	AUTHORS	AFFILIATION
The Concept of A Biodiverse-Friendly City in The Face of Climate Change	<ul style="list-style-type: none">• Hasan Yılmaz	Atatürk University (Türkiye)
Bicycle Roads as a Sustainable Transportation and Recreational Activity Areas: Case of Rize	<ul style="list-style-type: none">• Elif Şatıroğlu• Fatma Aydın	Recep Tayyip Erdoğan University (Türkiye)
Green Road Proposal for KTU Kanuni Campus and its Surroundings	<ul style="list-style-type: none">• Gülçay Ercan Oğuztürk• Müberra Pulatkan	Recep Tayyip Erdoğan University (Türkiye)
In Green Infrastructure Systems in Urban Areas The Importance of Soil Permeability	<ul style="list-style-type: none">• Gülçay Ercan Oğuztürk• Ömer Lütfü Çorbacı	Recep Tayyip Erdoğan University (Türkiye)
Micro Landscape Design in Urban Areas	<ul style="list-style-type: none">• Elif Sağlık	Çanakkale Onsekiz Mart University (Türkiye)
Bibliometric Analysis of Noise Barrier and Design Within The Scope of Highway Noise Planning	<ul style="list-style-type: none">• Merve Sipahi• Hasan Yılmaz	Recep Tayyip Erdoğan Üniversitesi (Türkiye)
Does the Public Agree on Coastal Reclamation in the Southeast Black Sea Region of Türkiye?	<ul style="list-style-type: none">• Neira Purwanti Ismail• Çoşkun Erüz	Karadeniz Technical University (Türkiye)
Examining the Sufficiency of Vertical Gardens in the Context of Rize Province	<ul style="list-style-type: none">• Elif Şatıroğlu• Fatma Aydın	Recep Tayyip Erdoğan University (Türkiye)



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SESSION-4, HALL-4 / OTURUM-4, SALON-4 MODERATOR: İsmail Emre Kavut		
TITLE	AUTHORS	AFFILIATION
Industry 4.0 and the Design Value of the Place of 3D Printers in Fictional Cinema Spaces	<ul style="list-style-type: none">Feyza Nur Dışkayaİsmail Emre Kavut	Mimar Sinan Fine Arts University (Türkiye)
Play Time: Samsun Canik Toy Museum	<ul style="list-style-type: none">Hande EyüboğluSerap Faiz Büyükcım	Samsun University (Türkiye)
The Relationship Between Sound and Aesthetics: an Assessment of Bursa Cumhuriyet Avenue	<ul style="list-style-type: none">Yalcın Yıldırım	Bursa Technical University (Türkiye)
From Showcase to Facade: Adaptation of Showcase Concepts to Store Facade Design	<ul style="list-style-type: none">Mertcan Öztekin	Yalova University (Türkiye)
Hassan Ragab's Spatial Art Using Midjourney in the Age of Artificial Intelligence	<ul style="list-style-type: none">Menşure Müezzinoğlu KübraSerpil AkanHalil Yasin Dilek	Fırat University (Türkiye)
From Vehicle to Space, Example of Adaptive Reuse in Office Design	<ul style="list-style-type: none">Ali Akçaova	Selcuk University (Türkiye)
Investigation of Decision-Making Methods for Energy Efficiency in the Early Design Phase of Buildings	<ul style="list-style-type: none">Rana UzunElif Özer Yüksel	Gebze Technical University (Türkiye)
A Conceptual Review on Second Home Tourism	<ul style="list-style-type: none">Yusuf Çağrı Türkseven	Mersin University (Türkiye)



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SESSION-4, HALL-5 / OTURUM-4, SALON-5 • MODERATOR: Nodar Sulashvili		
TITLE	AUTHORS	AFFILIATION
The Key Issue Aspects Related of Action and Outlook of Use Monoclonal Antibodies in Miscellaneous Immunotherapeutic Directions	<ul style="list-style-type: none"> • Nodar Sulashvili • Nana Gorgaslidze • Luiza Gabunia • Nato Alavidze • Marika Sulashvili 	Tbilisi State Medical University (Georgia)
The Key Issue Aspects, Characteristics and Effects of Antioxidants in Miscellaneous Immunotherapeutic Directions	<ul style="list-style-type: none"> • Nodar Sulashvili • Nana Gorgaslidze • Luiza Gabunia • Marina Giorgobiani • Marika Sulashvili 	Tbilisi State Medical University (Georgia)
The Key Issue Aspects Related of Action and Outlook of Use Monoclonal Antibodies in Miscellaneous Immunotherapeutic Directions	<ul style="list-style-type: none"> • Nodar Sulashvili • Nana Gorgaslidze • Luiza Gabunia • Marina Giorgobiani • Marika Sulashvili 	Tbilisi State Medical University (Georgia)
The Key Issue Aspects, Characteristics and Effects of Antioxidants in Miscellaneous Immunotherapeutic Directions	<ul style="list-style-type: none"> • Nodar Sulashvili • Nana Gorgaslidze • Luiza Gabunia • Marina Giorgobiani • Marika Sulashvili 	Tbilisi State Medical University (Georgia)
Wild Edible Mushrooms and Their Bioactive Compound Have Revealed Therapeutic Potential Against Various Diseases	<ul style="list-style-type: none"> • K.R. Padma • K. R. Don • M. Reshma Anjum • M. Sankari • P. Josthna 	Sri Padmavati Mahila VisvaVidyalayam (Women's) University (India)
The Global Burden of Antimicrobial Resistance	<ul style="list-style-type: none"> • Shabnam Thakur • Mohini Kalra 	Amity University Haryana (India)
Effect of the Incorporation of Plastic Waste on the Mechanical Properties of Composite Materials	<ul style="list-style-type: none"> • Omar Safer • Adem Ait Mohamed Amer • Mohamed Salhi • Nadia Belas Belaribi 	Nadia Belas Belaribi (India)
Effects of Poultry Waste Generation on the Environment in Ikot Ekpene (Rafia City), Southern Nigeria.	<ul style="list-style-type: none"> • Trustgod Idongesit Gabriel • Editi Etim Pau • Edet Edet Etim 	Akwa Ibom State Polytechnic (Nigeria)



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SESSION-4, HALL-6 / OTURUM-4, SALON-6 MODERATOR: Vaibhav Kant Singh		
TITLE	AUTHORS	AFFILIATION
Bone Fracture Detection System Using MI Approach	<ul style="list-style-type: none"> • Vaibhav Kant Singh 	Central University (India)
Synthesis and Characterization of Metal Molybdates for Degradation of Methylene Blue Through Catalytic Oxydation Reaction	<ul style="list-style-type: none"> • Yousra Taoudi • Mohamed Akouibaa • Hicham Oudghiri Hassani • Souad Rakass • Mostafa Abboudi • Brahim El Bali • Mohammed Lachkar 	Sidi Mohamed Ben Abdellah University (India)
Proposing Nlp Based News Classification System	<ul style="list-style-type: none"> • Vaibhav Kant Singh 	Central University (India)
Environmental Assessment of Indiscriminate Refuse Disposal in Arigbajo Area of Ogun State, Nigeria	<ul style="list-style-type: none"> • Oguntade Omotolani I. 	Ogun State Institute of Technology (India)
A Sustainable Phantom Imaging of Superparamagnetic Graphene Composites for Advanced Diagontherapeutic Application	<ul style="list-style-type: none"> • K. R. Preethy • R. Hemavarshini • Sucharita Nagesh • R. Amirtha Varshini • M. Chamundeeswari 	St. Joseph's College of Engineering (India)
Elaboration of Seawater Sand-Fly Ash Geopolymer Concrete: Synthesis, Microstructure, and Mechanical Behavior	<ul style="list-style-type: none"> • H. El harouachi • M. Elgettafi • M. Loutou 	Mohammed Premier University (India)
Investigation of Nickel Coatings Elaboration By Ca and Cp	<ul style="list-style-type: none"> • Amira Gharbi • Manel Dridi • Youcef Hamlaoui 	Mohamed Cherif Messaadia university (India)
Surveillance System Using the Concept o Computer Vision	<ul style="list-style-type: none"> • Vaibhav Kant Singh 	Central University (India)



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SESSION-5 HALL-1 / OTURUM-5, SALON-1 MODERATOR: Niyazi Uğur Koçkal		
TITLE	AUTHORS	AFFILIATION
The Advantages of Using Biodegradable and Eco-friendly Materials in Construction	<ul style="list-style-type: none">• İskender Emre Gül• Niyazi Uğur Koçkal	Akdeniz University (Türkiye)
Effect of Moisture on The Strength of Cross Laminated Timber	<ul style="list-style-type: none">• Mehmet Kara• Zehra Canan Girgin	Yıldız Technical University (Türkiye)
Investigation of Operational and Embodied Energy Throughout the Life Cycle of Buildings with Bibliometric Analysis: A Literature Review	<ul style="list-style-type: none">• Semahat Merve Top• Ebru Kiliç Bakırhan	Karabuk University (Türkiye)
Site Plan of the Bursa Mevlevihane Asitane during its Last Functioning Historical Period	<ul style="list-style-type: none">• Zeynep Tanrıverdi• Ş. Barihüda Tanrıkorur	Fatih Sultan Mehmet Vakıf University (Türkiye)
Routes and Traces: The Role of Construction Materials in Shaping the Pedestrian-Friendly Urban Environment	<ul style="list-style-type: none">• Ürün Biçer• Serkan Yaşar Erdiñ	İstanbul Beykent University (Türkiye)
Transformation From Waste Materials to Design	<ul style="list-style-type: none">• Handan Sabriye Yaman	Mehmet Akif Ersoy University (Türkiye)
Clay Brickmaking Techniques (Traditional – Modern Techniques)	<ul style="list-style-type: none">• Kaltrina Spahiu	University of Prishtina (Macedonia)
	<ul style="list-style-type: none">•	



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SESSION-5, HALL-2 / OTURUM-5, SALON-2 MODERATOR: Ümit Turgay Arpacıoğlu		
TITLE	AUTHORS	AFFILIATION
An Analysis of the Domed Mosques in the Provinve of Çankırı	<ul style="list-style-type: none">• Filiz Karakuş	Ankara Yıldırım Beyazıt University (Türkiye)
The Effect of the Environment on the Evaluation of Tall Building Forms	<ul style="list-style-type: none">• Aslı Yıldız• Pınar Dinç Kalaycı	Nevşehir Hacı Bektaş Veli University (Türkiye)
An Analysis on Natural and Artificial Lighting of Religious Buildings: Edirne Hasan Sezai Mosque	<ul style="list-style-type: none">• Burçin İrem Demirkol• Şule Yılmaz Erten	Trakya University (Türkiye)
Design of Elevators as a Vertical Circulation Element in High-Rise Buildings	<ul style="list-style-type: none">• Neslişah Mamati• Ali Osman Kuruşcu	Maltepe University (Türkiye)
Investigation of Monumental Mosques Belonging to the Ottoman Period in Konya in Terms of Energy Efficiency	<ul style="list-style-type: none">• Neriman Gül Çelebi• Ümit Turgay Arpacıoğlu	Mimar Sinan Fine Arts University (Türkiye)
Comparative Analysis of Steel and Reinforced Concrete Structural Frames in Terms of Environmental Impact	<ul style="list-style-type: none">• Neriman Gül Çelebi• Ümit Turgay Arpacıoğlu	Mimar Sinan Fine Arts University (Türkiye)
Degradation in Organic Exterior Coatings Against Physical Environmental Effects	<ul style="list-style-type: none">• Ahmet Cüneyd Diri	Mimar Sinan Fine Arts University (Türkiye)
Creating a City in Metaverse: Liberland	<ul style="list-style-type: none">• Dicle Kizildere Gökyer• Ecem Uğurlu	Gebze Technical University (Türkiye)



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SESSION-5, HALL-3 / OTURUM-5, SALON-3 MODERATOR: Mert Çakır		
TITLE	AUTHORS	AFFILIATION
The Effects of Gamma Irradiation on the Color and Chlorophyll Content of St. Augustinegrass	<ul style="list-style-type: none">• Mert Çakır• Songül Sever Mutlu	Süleyman Demirel University (Türkiye)
Investigation of Woody Plant Material in Squares: Case of Antalya, Türkiye	<ul style="list-style-type: none">• Hatice Bütüner Çetin• Cengiz Yücedağ• Nuray Çiçek	Burdur Mehmet Akif Ersoy University (Türkiye)
A Study on the Determination of Existing Ornamental Plants and Their Ecological Tolerance Levels in Diyarbakır Forest Nursery	<ul style="list-style-type: none">• Zeynep Toprak• Cengiz Yücedağ	Burdur Mehmet Akif Ersoy University (Türkiye)
Physical Properties of Fiber Reinforced Geopolymer Mortars	<ul style="list-style-type: none">• Ibrahim YETIS• Niyazi Uğur KOCKAL	Akdeniz University
The Importance of Walkability on University Campuses in the Context of Sustainable Cities and Communities	<ul style="list-style-type: none">• Yeliz Duygu Erçek• Nursevil Yuca	Van Yüzüncü Yıl University (Türkiye)
Ecological Contributions of Walkability to the City	<ul style="list-style-type: none">• Mahmut Tuğluer	• Kahramanmaraş Sütçü İmam University (Türkiye)
Effect of Cellulosic Fibers on The Mechanical Properties of Cement-Based Mortars	<ul style="list-style-type: none">• Ibrahim YETIS• Niyazi Uğur KOCKAL	• Akdeniz University
	<ul style="list-style-type: none">•	<ul style="list-style-type: none">•



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SESSION-5, HALL-4 / OTURUM-5, SALON-4 MODERATOR: Floriana Zucaro		
TITLE	AUTHORS	AFFILIATION
Application of Green Energy Technology For Environmental Sustainability	<ul style="list-style-type: none"> • K.R. Padma • K.R. Don 	Sri Padmavati Mahila Visvavidyalayam (Women's) University (India)
A Life Cycle Assessment Approach for Sustainable Practices	<ul style="list-style-type: none"> • P.S.S. Anjaneya Babu • Subhashish Dey 	Gudlavalleru Engineering College (India)
Eco-Literacy and Economic Development In Nigeria: A Symbiotic Relationship	<ul style="list-style-type: none"> • Shuaeeb, A. I., • Bello, R. M. • Idris, U. S. B. • Ndatsu, A. 	Federal University of Technology (Nigeria)
The Environmental and Economic Impacts of the Use of Recycled Asphalt During the Preventive Maintenance of Roadways in the UAE	<ul style="list-style-type: none"> • Aishah H.O. Al Shehhi • Gul Ahmed Jorkhio 	The British University in Dubai (United Arab Emirates)
Innovative Integration of Blast Furnace By-Products for Sustainable and Efficient Concrete Production	<ul style="list-style-type: none"> • Naoual Handel • Farida Khammar • Sarah Djouimaa 	Mohamed Cherif Messaadia University (Morocco)
Significance of Applying Innovative Context-Aware-Based Algorithms in Fleet Management Systems For Urban Mobility	<ul style="list-style-type: none"> • Naoum Tsolakis • Christos Koidis • Irodotos Aptalidis • Dimitrios Kalpaktsoglou • Dionysis Bochtis • Charisios Achillas • Dimitrios Aidonis 	International Hellenic University (Greece)
The Role of Human Capital and Technology Through Sustainable Development	<ul style="list-style-type: none"> • M. K. Ganeshan • C. Vethirajan 	Alagappa University (India)
	<ul style="list-style-type: none"> • 	



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TITLE	AUTHORS	AFFILIATION
Enhancement Factor For CO ₂ Adsorption Into Promoted Potassium Carbonate Solution	<ul style="list-style-type: none"> • Elisabeta Droniuc (Hultuana) • Ramona Tataru Farmus • Maria Harja 	Gheorghe Asachi Technical University of Iasi (India)
Nanostructured SnO ₂ Prepared by Sol-Gel Method and it's Applications	<ul style="list-style-type: none"> • Catalina Nuțescu Duduman • Consuelo Gómez De Castro • Maria Harja 	Gheorghe Asachi Technical University of Iasi (India)
Phyto-Synthesis of ZnO /Co ₃ O ₄ /MoO ₃ nanocomposite: An efficient ZnO/Co ₃ O ₄ /MoO ₃ /Nafion/ GC electrode	<ul style="list-style-type: none"> • Irum Shaheen 	Fatima Jinnah Women University (India)
Synergizing AI and Industry 5.0: Fostering Collaborative Innovation for Sustainable Growth	<ul style="list-style-type: none"> • Shweta Dewangan 	ICFAI University (India)
Analysis SWOT Dalam Strategi Pengembangan UMKM Petani Selada (Studi Kasus UMKM Alam Tani Hidrofarm Kudus)	<ul style="list-style-type: none"> • Delbi Rizka Adik Azhari • Riyan Andni 	Fakultas Ekonomi dan Bisnis Islam Institut Agama Islam Kudus (India)
Evaluation Impact Climate Change on Lettuce Hydroponic MSMEs (Study Case Alam Tani Hidrofarm Kudus)	<ul style="list-style-type: none"> • Delbi Rizka Adik Azhari • Riyan Andni 	Fakultas Ekonomi dan Bisnis Islam Institut Agama Islam Kudus (India)
Industrial Risk Analysis and Control Case Study «Terminal Arrive El Kala GK03 Sonatrach Algeria	<ul style="list-style-type: none"> • Dalila Khalfa • Oussama Meghlaoui • Abdelouahab Benretem 	• Annaba University (India)
Resilience and Psychological Wellbeing among Yoga-Practitioners and Non-Practitioners	<ul style="list-style-type: none"> • Nishant • Priya Choudhary • Hariom Sharma 	• Sharda University (India)



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SESSION-5, HALL-6 / OTURUM-5, SALON-6 MODERATOR: Gizem Dinç		
TITLE	AUTHORS	AFFILIATION
Preparation and Characterization of 45S5 Bioglass From Rice Husk Ash and Eggshell Ash as Alternative Resources by Microwave Energy Assisted Melt-Quenching Approach	<ul style="list-style-type: none"> • Seun Samuel Owoeye • Davies Oladayo Folorunso • Fatai Aramide • Believe Okotie 	Federal Polytechnic (Algeria)
Evaluation of the Performance of the FPS System in Controlling the Seismic Response of the Medium-Rise Building	<ul style="list-style-type: none"> • Hadj Mohamed Ounis • Abdelhafid Ounis 	Mostefa Ben Boulaid University (Algeria)
A Study of Two Parameters Based Flexible Probability Model with Properties and Applications	<ul style="list-style-type: none"> • Shahida Perveen • Abdus Saboor 	Kohat University of Science and Technology (Algeria)
Study of the Feasibility of Production of Titanium Oxide as a Porous Support for Whole Cells Immobilization with Enzymatic Activity	<ul style="list-style-type: none"> • Jéssica Barbosa Fanis • Elisabete Maria Minussi • Karla De Almeida Duran • Gustavo Aparecido Nagae Teixeira • Rafael Firmani Perna • Sylma Carvalho Maestrelli 	Federal University of Alfenas (UNIFAL-MG) (Brazil)
Phase Behavior and Role of Organic Additives for Self-Doped CsPbI ₃ Perovskite Semiconductor Thin Films	<ul style="list-style-type: none"> • Tamiru Kebede • Jung Yong Kim 	Jimma University (Ethiopia)
Determining the Mutual Wetting Capabilities of Oil-Water: Polymer: Rock in Some Oil Fields in Albania	<ul style="list-style-type: none"> • Lorina Liçi • Drilona Sauli • Ardit Mihali 	Polytechnic University of Tirana (France)
Application of Artificial Intelligence in Different Aspects of Fundamental Sciences	<ul style="list-style-type: none"> • Tinatin Mshvidobadze 	Gori State University (Georgia)
Polyaniline – Based Matrix Nanocomposite as Sensing Layer for Resistive Humidity Sensor	<ul style="list-style-type: none"> • Bogdan-Catalin Serban • Octavian Buiu • Marius Bumbac 	National Institute for Research and Development in Microtechnologies–IMT Bucharest (Romania)



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SESSION-6, HALL-1/OTURUM-6, SALON-1 MODERATOR: H. Berk Türker		
TITLE	AUTHORS	AFFILIATION
Vehicle to Vehicle Communication Using Lifi Technology	<ul style="list-style-type: none"> • Kavitha. T • Vandhana. M • Sinduja. S 	RMK Engineering College (India)
New Approach for Prediction the AC Breakdown Voltage Using Design of Experiments	<ul style="list-style-type: none"> • Hani Benguesmia • Badis Bakri • Nour Eddine Salmi • Oqba Belabbas 	University of M'sila (India)
Corrosion and Microstructure Behaviour of Electrical Discharge Coated AZ91 Magnesium Alloy for Biomedical Application	<ul style="list-style-type: none"> • U. Elaiyaranan • V. Satheeshkumar • C. Senthilkumar 	Easwari Engineering College (India)
Cyclohexane-1,3-Dione Derivatives for Prospective Anti-NSCLC Cancer Efficacy through Integrated QSAR and Docking Explorations	<ul style="list-style-type: none"> • Khaoula Mkhayar • Souad El khattabi 	Easwari Engineering College (India)
A Study on Engineering Properties of Dense Grade Bituminous Mixes With Coal Ash By Using Natural Fiber	<ul style="list-style-type: none"> • Ramireddy Sushmitha • S V Garata Reddy 	G. Pulla Reddy Engineering College (Autonomous) (India)
A Survey of Machine Learning-Based Prediction Methods For Heart Disease	<ul style="list-style-type: none"> • A. Rajeswari 	G. Venkataswamy Naidu College (India)
Distributional Patterns of Hoverflies Along an Elevational Gradient in North-Western Himalayas, India	<ul style="list-style-type: none"> • Amir Maqbool • Iqra Maqbool • A Najitha Banu • Aijaz Ahmad Wachkoo 	Lovely Professional University (India)
A New Way of Enhancing Visible Light Activity of TiO ₂ for the Treatment of Dyes in Wastewater	<ul style="list-style-type: none"> • Neda Tabassum • Qazi Inamur Rahman 	Integral University (India)



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SESSION-6, HALL-2 / OTURUM-6, SALON-2 MODERATOR: Bahia Messai		
TITLE	AUTHORS	AFFILIATION
Effect of Sr, F Codoping in Structural and Dielectric Properties of Pzt-Based Ceramics	<ul style="list-style-type: none"> • Bahia Messai • Rachid Makhloufi • Aymen Benmakhlof 	Biskra University (Algeria)
Influence of Sr And F Co-Doping on the Structural, Morphological and Dielectric Properties of Pzt Ceramics	<ul style="list-style-type: none"> • Bahia Messai • Rachid Makhloufi 	Biskra University (Algeria)
Image Recognition in an Uncontrolled Environment Using Artificial Neural Network and Convolutional Neural Network	<ul style="list-style-type: none"> • Fati Oiza Ochepe • Malik Adeiza Rufai • Joshua Abel Alhassan • Kharimah Bimbola Ahmed 	Federal University Lokoja (Nigeria)
Materials Informatics Using Machine Learning/Data Science: Prospects and Limitations for the African Society	<ul style="list-style-type: none"> • Thomas O. Daniel 	Alex Ekwueme Federal University Ndufu-Alike (Nigeria)
Design and Development of Laboratory Scale Pencil Leads Extrusion Die	<ul style="list-style-type: none"> • Abubakar Ibrahim Ibrahim • Musa Zahradeen • Kasim Auwal • Gaminana Jimoh Ohinoyi • Rayyan Mamuda Dodo • Shehu Umar 	Ahmadu Bello University (Nigeria)
Kinetic modeling of powder-pack boronizing for 4Cr5MoSiV1 Steel using dimensional analysis	<ul style="list-style-type: none"> • Katia Benyakou • Mourad Keddou • Brahim Boumaali 	Laboratoire de Technologie des Matériaux (Nigeria)
Matrimony through Time: Exploring Marriage Customs and Rituals across Diverse Ancient Civilizations	<ul style="list-style-type: none"> • Amirul Islam • Murshida Khatun • Tarek Rahman Likhon 	University of Rajshahi (Nigeria)
Case Method: Tightening Security to Ensure Integrity	<ul style="list-style-type: none"> • Camberlyalice Binti Roger • Dannielle Dezzie Edward • Alyie Ain Suiab Suib • Alzulika Alzie Binti Alidun 	University of Rajshahi (Nigeria)



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SESSION-6, HALL-3 / OTURUM-6 SALON-3 MODERATOR: Tuba Gizem Aydoğan		
TITLE	AUTHORS	AFFILIATION
A Proposal for Investigation of Photonic Crystal Biosensors by Using Artificial Neural Networks	<ul style="list-style-type: none"> • Nazanin Najjari • Saeed Olyae 	Shahid Rajaei Teacher Training University (Iran)
Free Vibration Analysis of Circular Sandwich Plates Reinforced By Functionally Graded Nano-Graphene Materials Using 3d Finite Element Method	<ul style="list-style-type: none"> • Mohammad Mahdi Kheirikhah 	Islamic Azad University (Iran)
Air Quality Monitoring: Measurement of PM2.5 and PM10 Fine Particles Using Sensor Technology	<ul style="list-style-type: none"> • Leila Naceri • Zakia Lounis 	ENP Oran-Maurice AUDIN (Iran)
Interaction Between the Turbulent Natural Convection of Nanofluids and External Magnetic Fields in a Rectangular Cavity	<ul style="list-style-type: none"> • Zakaria LAFDAILI 	Mohammed V University (Morocco)
A Comparative Study Between SPWM and SHE-PWM Modulation Techniques for a Single-Phase Inverter	<ul style="list-style-type: none"> • Ramzi El Idrissi • Abdelkadir Bacha • Fatima Lmai 	Hassan II University (Morocco)
The Phosphate of Morocco: Paleogeography of the Maastrichtian of the Western High Atlas	<ul style="list-style-type: none"> • Jdaba Naji., • Algouti Ahmed., • Aydda Ali., • Hadach Fatiha. • Tabit Abdelhalim. 	University of Ibn Zohr (Morocco)
Effect of Temperature on Damage Stages of CPVC	<ul style="list-style-type: none"> • Abderrahim Khtibari • Abderrazak En-Naji • Abdelkrim Kartouni • Mohamed El Ghourba 	Hassan II University (Morocco)
Skin Disease Diagnosis Using Machine Learning and Internet of Things (Iot)	<ul style="list-style-type: none"> • Jeyapoornima.B • Shalini.R 	RMK Engineering College (Morocco)



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SESSION-6, HALL-4 / OTURUM-6, SALON-4 MODERATOR: Ahmet Erkan Metin		
TITLE	AUTHORS	AFFILIATION
An Online Tricycle Ticketing System For Federal Polytechnic Bida	<ul style="list-style-type: none"> • Yusuf Alhaji Salihu • Abdulazeez Mohammed Shettima 	Computer Science Department Federal Polytechnic (Morocco)
QSAR, ADME-Tox, Molecular Docking and Molecular Dynamics Simulations of Novel Selective Glycine Transporter Type 1 Inhibitors With Memory-Enhancing Properties	<ul style="list-style-type: none"> • Mohamed El fadili • Mohammed Er-rajy • Hamada Imtara • Omar M. Noman • Ramzi A. Mothana • Sheaf Abdullah • Sara Zerougui • Menana Elhallaoui 	Sidi Mohammed Ben Abdellah University (Morocco)
Green Synthesis of Silver Nanoparticles Using Seaweed and Their Antibacterial Activity	<ul style="list-style-type: none"> • Aasma Hashmi • Saira Yasmeen • Samina Parveen • Muhammad Saad • Munawwer Rasheed 	Jinnah University for Women (Morocco)
Effect of Film Thickness on the Structural Propertie of Ferroelectric Bi₂FeCrO₆ Perovskite Thin films	<ul style="list-style-type: none"> • B. Ait Ali • R. Moubah • S. Colis 	Hassan II university of Casablanca (Morocco)
Dielectric Properties of Rare-Earth Doped TiO₂	<ul style="list-style-type: none"> • Sara Ezairi • Assaad Elouafi • Fatima Lmai • Abdesslam Tizliouine 	Hassan II University- Casablanca (Morocco)
Three-dimensional Lattice Boltzmann Study	<ul style="list-style-type: none"> • Karim Choukrallah • Nouredine Abouricha • Aachak Mouna 	Chouaib Doukkali University El Jadida (Morocco)
Laboratory Evaluation and Parameters Optimization of Hydraulic Ram Pump Using Locally Sourced Materials	<ul style="list-style-type: none"> • Al-Amin Danladi Bello • Aliyu Bamaiyi Usman • Attah, Ugbede Samuel • Inusa Musa • Surajo Abubakar Wada • AbdulAziz Ahmad 	Ahmadu Bello University (Morocco)
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SESSION-6 HALL-5 /OTURUM-6 SALON-5 MODERATOR: Mert Akoğlu		
TITLE	AUTHORS	AFFILIATION
Effects of Fire Outbreaks in Ecosystems on Habitats and Distribution Patterns of Terrestrial mammals in Iran	<ul style="list-style-type: none"> Nafiseh Faghih Sabzevari 	Ferdowsi University of Mashhad (Iran)
Application of Proline as Pre-Sowing Seed Treatment on Okra Under Water Deficit Conditions	<ul style="list-style-type: none"> Arshia Zia 	University of Agriculture (India)
Assessment of Flood Spreading Impact on Groundwater Quality and Groundwater Level Variation Using Geospatial and ERS Technique	<ul style="list-style-type: none"> Rabia Dars Jianhua Ping Sheheryar Khan Rudan Zheng 	School of Water Conservancy and Civil Engineering at Zhengzhou University Henan (China)
Comparative Study Between Fuzzy Controller and ANFIS Controller for Quadruple Tank System	<ul style="list-style-type: none"> Ali Akka Oussama Moussa Ali Bouzidi Alouani Helalli 	University of Ghardaia (France)
Solutions to Expand the Tourism Industry in Border Cities With Emphasis on Handicrafts	<ul style="list-style-type: none"> Kamal Koohi Jamal karamravan 	University of Tabriz (Iran)
Renewable Energy	<ul style="list-style-type: none"> Kevin Budlla 	Student in Turgut Ozal Durrus College (Romania)
Travel Tourism and Tourism Industry In Indonesia	<ul style="list-style-type: none"> Hendri Hermawan Adinugraha Ahmad Anas 	UIN K.H. Abdurrahman Wahid Pekalongan (India)
	<ul style="list-style-type: none"> 	



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SESSION-6-HALL-6 /OTURUM-6- SALON-6 MODERATOR: Orhan Alav		
TITLE	AUTHORS	AFFILIATION
Sikh Museums as a Source of Imparting Knowledge Traditions	<ul style="list-style-type: none"> • Kulwinder Kaur • Daljit Kaur 	University of Delhi (India)
Crime Data and Information Management System	<ul style="list-style-type: none"> • Sali Mohammed Bobboi • Nurudeen Abubakar Sadiq • Nyako Alhaji Bab • Abdulwasiu Bamidele Aremu 	Federal Polytechnic Kaltungo (Pakistan)
Climate Change, Trafficking, and Prostitution: Exploring Interlinked Vulnerabilities	<ul style="list-style-type: none"> • Pyali Chatterjee • Shailesh N Hadli 	The ICFAI University (Nigeria)
News/Events Automation System	<ul style="list-style-type: none"> • Sali Mohammed Bobboi • Abatcha Alhaji Kurna • Lukman Ibrahim • Nura Muhammad Sani 	Federal Polytechnic Kaltungo (Nigeria)
Chemical Analysis of the River of Prizren, Through Instrumental Analytical Methods	<ul style="list-style-type: none"> • Skender Demaku • Donika Sylejmani • Arbnorë Alu • Bahrije Dobra • Jeton Halili 	University of Pristina (Kosovo)
Integrated Analysis to Assess the Excavatability of Subsurface Geomaterials Using Seismic Refraction and Geotechnical Methods in Perai, Malaysia	<ul style="list-style-type: none"> • Bala Balarabe • Andy Anderson Bery 	Ahmadu Bello University (Malaysia)
Construction of Mobile Phone Detector for Use in Phone Prohibited Environment	<ul style="list-style-type: none"> • Ikpe, Emem Okon • Paul, Editi Etim • Effiong, Enobong Jeremiah 	Akwa Ibom State Polytechnic (Nigeria)
	<ul style="list-style-type: none"> • 	



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SESSION-7, HALL-1 / OTURUM-7, SALON-1 MODERATOR: Aybike Ayfer Karadağ		
TITLE	AUTHORS	AFFILIATION
Urban Sustainability Indicators and Open-Green Spaces	<ul style="list-style-type: none"> Aybike Ayfer Karadağ Demet Demiroğlu 	Düzce University (Türkiye)
Analyzing Spatial Configuration Çankırı Historical City Center	<ul style="list-style-type: none"> Pelin Şahin Körmeçli 	Cankırı Karatekin University (Türkiye)
Imageability as a Tool for Urban Character Assessment- UCA, Manama Old Town, Bahrain	<ul style="list-style-type: none"> Abdurrahman Mohamed 	Antalya Bilim University (Türkiye)
Examination of Green Infrastructure Phenomenon in the World	<ul style="list-style-type: none"> Hayriye Tunç Aybike Ayfer Karadağ 	Düzce University (Türkiye)
Fleet Management System for Optimized Agricultural Production in Urban Environments	<ul style="list-style-type: none"> Christos Koidis Athanasios Bantsos Katerina Tzafilkou Charisios Achillas Dimitrios Aidonis Dionysis Bochtis Dimitrios Gelasakis 	International Hellenic University (Greece)
The Role of Woody Ecosystems In Urban Areas Landscape Architecture	<ul style="list-style-type: none"> Maksim O. Kvitko Olena A. Lykholat Tetyana Y. Lykholat Yuriy V. Lykholat 	Kryvyi Rih State Pedagogical University (Macedonia)
Influence of Digitalisation on Construction Project Delivery: A Review	<ul style="list-style-type: none"> Isah, Hassan Alhassan Isa, Rasheed Babatunde Ihedigbo, Kingsley Sunday 	Federal University of Technology (Algeria)
	<ul style="list-style-type: none"> 	



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SESSION-7 HALL-2 / OTURUM-7, SALON-2 MODERATOR: Lale Karataş		
TITLE	AUTHORS	AFFILIATION
Integrated Design Approach in Nature-Architecture Relationship	<ul style="list-style-type: none">• Özge Zenter• M. Tayfun Yıldırım	Gazi Üniversitesi (Türkiye)
New Building Designs in Historical Cities: Museum Architecture	<ul style="list-style-type: none">• Gizem Kuşak Toprak	Ostim Technical University
Sustainability of Conservation Project of the Residential Buildings at the Historical District of Jeddah	<ul style="list-style-type: none">• Shabnam Golkarian	Near East University
	<ul style="list-style-type: none">•	
Contemporary Buildings in Rural Settlements	Zahide Sena Güneş Kaya	İstanbul University (Türkiye)
Searching for Nature in Architecture in the Historical Process and Biophilic Design	<ul style="list-style-type: none">• Mine Batal	İstanbul Yeni Yüzyıl University (Türkiye)
Archaeological Museum as Medium-Space: Representation of the Past in Troy and Acropolis Museum	<ul style="list-style-type: none">• Beril Sezen	Istanbul Technical University (Türkiye)
Examining Preschool Education Buildings with Sustainable Architectural Approach: Two Examples in Konya Selçuklu	<ul style="list-style-type: none">• Mine Sungur	Selçuk University (Türkiye)



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SESSION-7, HALL-3 / OTURUM-7, SALON-3 • MODERATOR: Asena Soyluk		
TITLE	AUTHORS	AFFILIATION
The Seismic Vulnerability of Historical Masonry Bridges: The Case Study of February 2023 Earthquakes	<ul style="list-style-type: none">• Asena Soyluk• Ayşe Gülce Karakaya	Gazi University (Türkiye)
Temporary Foldable Children's Socialization Spaces After Earthquake: Interior Architecture Workshop Experience	<ul style="list-style-type: none">• Hatice Çınar• Mehmet Norash	Selçuk University (Türkiye)
A Chronological Inquiry on the Destructive Effects of the Earthquakes on Urban Identity: Bursa Case	<ul style="list-style-type: none">• Merve Dilman Gokkaya• Nazli Deniz Ersoz• Gul Sayan Atanur	Bursa Technical University (Türkiye)
A Design Experiment On Temporary Shelter After Earthquake: Modular Basic Living Unit	<ul style="list-style-type: none">• Pınar Öktem Erkartal• Orkunt Turgay	Istanbul Galata University (Türkiye)
Investigation of the Impacts of Firefighting Approaches on Historical Building and Environment After the Fire	<ul style="list-style-type: none">• Bilgehan Bakırhan• Figen Beyhan	Karabük University (Türkiye)
Evaluation of the Relationship of Social Vulnerability to Excessive Rainfall With Spatial Vulnerability Based on Location Selection Characteristics: The Case of İzmir	<ul style="list-style-type: none">• Ezgi Göztek• Mediha Burcu Sılaydın	Dokuz Eylül University (Türkiye)
Development of Digital Technology and Architectural Design; A Study on the Reflection of Virtual Reality Themed Films and Metaverse Universe Interaction on Architectural Design	<ul style="list-style-type: none">• Ayşegül İpçioğlu	Eskişehir Osmangazi University (Türkiye)
An Analysis of Multi-Sensory Experience and Activity in Street	<ul style="list-style-type: none">• Özlem Demirkan• Kerim Çınar	KTO Karatay University (Türkiye)



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SESSION-7, HALL-4 / OTURUM-7, SALON-4 MODERATOR: H. Berk Türker		
TITLE	AUTHORS	AFFILIATION
Computer Aided Drug Design and Discovery of Novel Anticancer Agents	<ul style="list-style-type: none"> • Said El Rhabori • Samir Chtita • Fouad Khalil 	Sidi Mohamed Ben Abdellah University (Morocco)
The Double Role of Nutrients In Immunity	<ul style="list-style-type: none"> • Gheorghe Giurgiu • Manole Cojocaru • I, Eusplm 	Titu Maiorescu University (India)
The Use of Fractals in Cancer Research	<ul style="list-style-type: none"> • Ajsel Budlla 	Turgut Ozal College Durres (Algeria)
X-Ray And Ct Images In Covid-19 Detection Using Image Processing And Deep Learning Techniques: A Comparative Study	<ul style="list-style-type: none"> • S. Sivasakthi 	G. Venkataswamy Naidu College (Nigeria)
Biological Warfare: A Safe and Effective Solution for Controlling Mosquito-Borne Diseases in Urban Areas	<ul style="list-style-type: none"> • Zhang, Ruochen Alexandra • Ulya Shirinzade 	Basis International School Nanjing (Nigeria)
Quicklime Production from Eggshell Using Response Surface Methodology	<ul style="list-style-type: none"> • Salisu Nuhu 	Hussaini Adamu Federal Polytechnic Kazaure (Nigeria)
Development and Performance Evaluation of a Millet Dehuller	<ul style="list-style-type: none"> • O. A. Adetola • E. O. Daodu 	Federal University of Technology Akure (Nigeria)
	<ul style="list-style-type: none"> • 	



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SESSION-7, HALL-5 / OTURUM-7, SALON-5 MODERATOR: Bogdan-Catalin Serban		
TITLE	AUTHORS	AFFILIATION
Novel Resistive Sensor for Indoor Formaldehyde Pollution	<ul style="list-style-type: none"> • Bogdan-Catalin Serban • Octavian Buiu • Marius Bumbac 	National Institute for Research and Development in Microtechnologies-IMT Bucharest (Romania)
Novel Sensor for Relative Humidity Home Monitoring	<ul style="list-style-type: none"> • Bogdan-Catalin Serban • Octavian Buiu • Marius Bumbac 	National Institute for Research and Development in Microtechnologies-IMT Bucharest (Romania)
Strategies for Overcoming Difficult Situations Among the Roma Population in Romania	<ul style="list-style-type: none"> • Sorina Corman 	University of Sibiu, (Romania)
Electrocatalytic Synthesis of Hydrogen and Ammonia Fuels	<ul style="list-style-type: none"> • Hanfeng Liang 	Xiamen Üniversiteye (Nigeria)
Novel Resistive Ammonia Sensor	<ul style="list-style-type: none"> • Bogdan-Catalin Serban • Octavian Buiu • Marius Bumbac 	National Institute for Research and Development in Microtechnologies-IMT Bucharest (Romania)
Application of 2.5 MeV PIXE Analytical Techniques to Coastal Sediments: Insights into Elemental Composition and Environmental Implications	<ul style="list-style-type: none"> • V. N. Amadi 	Federal University Ndufu-Alike (Morocco)
Corrosion Control With Furfural Derivatives (5(hydroxymethyl) Furfural, and 5-(hydroxymethyl furoic acid) Using DFT	<ul style="list-style-type: none"> • Balkard Bouchra • Zajli Hanane • Bourzi Hassan 	• Ibn Zohr University (Nigeria)
Comparison of the Engineering Properties of Dgb Mixes with Coal Ash Using Natural Fibers	<ul style="list-style-type: none"> • Ramireddy Sushmitha • S. V Garata Reddy 	• G. Pulla Reddy Engineering College (Nigeria)



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SESSION-7, HALL-6 / OTURUM-7, SALON-6 MODERATOR: Vaibhav Kant Singh		
TITLE	AUTHORS	AFFILIATION
A ML Based Approach For the Detection of Phishing Cites Over Web	• Vaibhav Kant Singh	Central University (Nigeria)
Making a Prediction of Disaster Tweets by taking Advantage of the Existing Machine Learning Models	• Vaibhav Kant Singh	Central University (Nigeria)
Estimation and Prediction of Biogas Generation From Tizi Ouzou Landfill by LandGem Mathematical Model	• Toumi Meriem • Abdelli Islem Safi • Addou Ahmed • Abdelmalek Fatiha	University of Mostaganem Abdelhamid Ibn Badis (Nigeria)
Effect of Chieranthus Chieri Seeds on Pancreatic Physiology and Beta-Cell Regeneration in Alloxan Induced Diabetic Rats	• Humaira Muzaffar • Muhammad Naeem Faisal • Haseeb Anwar • Arslan Iftikhar • Shazad Irfan • Imran Mukhtar • Maham Fatima	Government College University Faisalabad (Pakistan)
MoS2 Nanomaterials for Photocatalysis	• Sameen Fatima • Muhammad Naeem • Siddiqa Fatima • Yasir Javed	University of Agriculture Faisalabad (Pakistan)
The Problem of Tolerance In History	• Svitlana Hanaba	National Academy of the State Border Guard Service of Ukraine named after Bohdan Khmelnytskyi (Pakistan)
Thermodynamic and Magnetocaloric Properties of a Graphullerene 2D Nanomaterial	• Sanae Zriouel	CADI AYYAD University (Nigeria)
A New Approach for Weapon Detection Utilizing the Novel YOLO V3 Algorithm	• Vaibhav Kant Singh	Central University (Nigeria)



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SESSION-8, HALL-1 / OTURUM-8, SALON-1 MODERATOR: Kağan Günce		
TITLE	AUTHORS	AFFILIATION
Unveiling the Thrilling Coasts: Exploring Contemporary Waterfront Design Theories	<ul style="list-style-type: none">• Doğa Üzümcüoğlu• Mukaddes Polay	Rauf Denktas University (Cyprus)
Social Sustainability in Public Interiors: Accessibility of Wheelchair Users in the Case of İstanbul's Piers and Ferries	<ul style="list-style-type: none">• Seden Odabaşoğlu• Melis Ceyhan	Marmara University (Türkiye)
Decay as a Field of Formlessness in Architecture	<ul style="list-style-type: none">• Hale Gönül• Bülent Tanju	Mimar Sinan Fine Arts University (Türkiye)
Remote Sensing of Metallic Structures Joined By Rivets From Architectural Heritage Elements	<ul style="list-style-type: none">• Rozina Steigmann• Gabriel Silviu Dobrescu• Ionut Mititelu• Nicoleta Iftimie• Adriana Savin	National Institute of Research and Development for Technical Physics (Romania) (Türkiye)
A Semiotic Analysis of the Reflection of Graphic Art on Media Designs: Posters of Chip Kidd	<ul style="list-style-type: none">• Ahmet Göktuğ Kılıç	İnönü University (Türkiye)
Designing the Pediatric Emergency Service and Polyclinic by Using the ADDIE Model in Interior Design	<ul style="list-style-type: none">• Mehmet Noraslı	Selcuk University (Türkiye)
Discipline and Ambivalence in Architectural Representation Practices	<ul style="list-style-type: none">• Tutku Sevinç	Istanbul Technical University (Türkiye)
Case Study of an Industrial Hall Assessment Based on Radar Techniques to Turn into a Museum of Industrial Archeology	<ul style="list-style-type: none">• Nicoleta Iftimie• Dan Alexandru Ghiga• Dragos Ungureanu• Rozina Steigmann• Gabriel-Silviu Dobrescu• Adriana Savin	National Institute of Research and Development for Technical Physics (Romania)



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SESSION-8, HALL-2 / OTURUM-8, SALON-2 MODERATOR: Tendü Hilal Göktuğ		
TITLE	AUTHORS	AFFILIATION
An Investigation of KTO Karatay University Central Campus According to Accessibility and Universal Design Principles	<ul style="list-style-type: none">• Zafer Kuyrukçu• Ayşegül Berber	Konya Technical University (Türkiye)
A Research to Determine Suitable Park Themes for the City of Aydın	<ul style="list-style-type: none">• Burhan Eşlik• Mine Kahya• Ekber Can Yildirim• Tendü Hilal Göktuğ	Aydın Adnan Menderes University (Türkiye)
Recreational Camping Area in Lake Van and Its Surroundings: The Case of Çakıl Island	<ul style="list-style-type: none">• Üzeyir Aydın• Feran Aşur	Van Yuzuncu Yıl University (Türkiye)
Evaluation of Kızıldağ National Park in terms of Daily Activities and Spatial Adequacy	<ul style="list-style-type: none">• İshak Ertaş• Cengiz Yücedağ	Burdur Mehmet Akif Ersoy University (Türkiye)
An Assessment of Surface Water Analysis in Beki River Basin, Assam	<ul style="list-style-type: none">• Saurabh Kumar Sarma• Ch. Udaya Bhaskara Rao	Mizoram University (Türkiye)
Reconciling the Local and the Modern: An Overview of Housing Designs in Abdullah Onar's Architecture	<ul style="list-style-type: none">• Ezgi Yavuz	Gebze Technical University (Türkiye)
Perception of Open Public Spaces as Urban Landmarks: A Study among College Students	<ul style="list-style-type: none">• Hanife Vardı Topal	Izmir Katip Celebi University (Türkiye)
Smart Cities of the Future	<ul style="list-style-type: none">• Teodora Rizova	New Bulgarian University (Macedonia)



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SESSION-8, HALL-3 / OTURUM-8, SALON-3 MODERATOR: Şirin Gülsen Eren		
TITLE	AUTHORS	AFFILIATION
Responsible Cultural Heritage Consumption for Senior Tourists in the Walled City of Nicosia	<ul style="list-style-type: none">• Gizem Güvenbaş• Mukaddes Polay	Rauf Denktas University
World Heritage Areas of Istanbul: Analysis of Criteria And Approaches to Conservation	<ul style="list-style-type: none">• Tuğba Tümel• Hüseyin Cengiz	Istanbul Ticaret University (Türkiye)
Analysis of the Building-Street Relationship Concept in Arnavutköy, Bebek and Beşiktaş Çarşı Regions	<ul style="list-style-type: none">• Berfin Yılmaz	İstanbul Nişantaşı University (Türkiye)
A Heritage Management Model Proposal for An Integrated Conservation of Cultural Heritage: Case of Ordu Historical City Center	<ul style="list-style-type: none">• Sabiha Okur• Elif Mihçioğlu	TOBB University of Economics and Technology (Türkiye)
A Methodological Approach To the Sustainability of Cultural Heritage: Cultural Heritage in Digital Game Design	<ul style="list-style-type: none">• Aysen Celen Öztürk• Elif Atıcı	Eskisehir Osmangazi University (Türkiye)
Digital Approach to Documenting Cultural Heritage Dynamics in Hasankeyf	<ul style="list-style-type: none">• Deryanur Şimşek• İzzettin Kutlu	Mardin Artuklu University (Türkiye)
Who owns it? The Neglect of Cultural Heritage: An Example from Central Anatolia	<ul style="list-style-type: none">• Betül Tağ• Can Şakir Binan	Istanbul Yeni Yuzyil University (Türkiye)
The Ancient City of Cnidus (Knidos) and Its Natural Environment	<ul style="list-style-type: none">• Onur Hazal Aslan	Istanbul Yeni Yuzyil University (Türkiye)



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SESSION-8, HALL-4 / OTURUM-8, SALON-4 MODERATOR: Şevket Alp		
TITLE	AUTHORS	AFFILIATION
Design and Planning Suggestions to Improve Thermal Comfort in Cities	<ul style="list-style-type: none"> • Nursevil Yuca • Şevket Alp 	Van Yüzüncü Yıl University (Türkiye)
Expert Approach in Visual Landscape Evaluation of Emre Lake	<ul style="list-style-type: none"> • Mehmet Bayram Kirazlı • Feran Aşur 	Van Yuzuncu Yıl University (Türkiye)
Investigation of the Impact of Construction Activities on Beach Marine Litter Pollution	<ul style="list-style-type: none"> • Neira Purwanty Ismail • Koray Özşeker • Çoşkun Erüz • Güler Erüz 	Karadeniz Technical University (Türkiye)
Exploring the Wide-ranging Ecosystem Services of Riparian Vegetation on a Global Scale	<ul style="list-style-type: none"> • Emine Keleş 	Trakya University (Türkiye)
Urban Architecture in Baltic Countries Between Central European and Nordic (Scandinavian) Trends	<ul style="list-style-type: none"> • Sándor Földvári 	Debrecen University (India)
A Study of the Properties and Components of Medicinal and Aromatic Plants In a Desert Region of Algeria	<ul style="list-style-type: none"> • Djellouli Amir • Berredjem Yamina • Hattab Zhou • Guesmia Hadjer • Mokhtar Mhenni • Azri Naima • Yagoub Mohamed 	Université mohammed chérif mesaadia de Souk-Ahras (Algeria)
Institutional Improvement Master in Food And Farming Association in Pakistan: A Review by Dr Faisal	<ul style="list-style-type: none"> • Muhammad Faisal 	Ministry of Human Rights Commission (Vietnam)
A Field Study of the Biodiversity Characteristics of A Dam in an Algerian Desert Region	<ul style="list-style-type: none"> • Djellouli Amir • Berredjem Yamina • Guesmia Hadjer • Mokhtar Mhenni • Azri Naima • Sara Ncibi 	Université Mohammed Chérif Mesaadia De Souk-Ahras (Algeria)



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SESSION-8, HALL-5 / OTURUM-8, SALON-5 MODERATOR: Doğa Demirel		
TITLE	AUTHORS	AFFILIATION
ZnBr ₂ -Mediated Synthesis of Blue-Light-Emitting CsPbBr ₃ Perovskite Quantum Dots via Supersaturated Recrystallization	<ul style="list-style-type: none"> • Dula Adugna Idosa 	Jimma University (Nigeria)
Room Temperature Synthesis of CsPbBr ₃ Perovskite Nanocrystals with Olive Oil and Oleylamine	<ul style="list-style-type: none"> • Getachew Welyab Tsoni 	Jimma University (Nigeria)
The Key Drivers for the Water Stress: An Empirical Analysis From Balkan Countries	<ul style="list-style-type: none"> • Llesh Lleshaj • Besa Shahini 	University of Tirana (Nigeria)
Cybernetic Hotel Management and Reservation System	<ul style="list-style-type: none"> • Sali Mohammed Bobboi • Albashir Ahmad • Yakubu A. Lidani • Maryam Abubakar Sharif 	Federal Polytechnic Kaltungo (Nigeria)
A Study of The Effect of Multi-Walled Carbon Nanotubes on Polybutylene Terephthalate	<ul style="list-style-type: none"> • Zoubeida Taha Taha • Andrea Adámné Major 	Óbuda University (Ukraine)
The Effect of Machining Parameters on Milling Process of Rene108 Type Nickel-Based Superalloys	<ul style="list-style-type: none"> • Gábor Kónya • Zsolt F. Kovács 	John von Neumann University (Hungary)
Correlation on Physical Mechanism of Titanium Dioxide-Chitosan Micro-Encapsulated For Photo Dyes Reduction in A Microfluidic Device	<ul style="list-style-type: none"> • Nurhidayatullaili Binti Muhd Julkapli • Ir. Ts. Dr. Lai Chin Wei • Ir. Ts. Mohd Fadhil Majnis 	University of Malaya (Malaysia)
Fuzzy Logic Controller Optimized by BBO for Decentralized Source Based on a SOFC	<ul style="list-style-type: none"> • Ali Akka • Oussama Moussa • Ali Bouzidi • Alouani Helalli 	University of Ghardaia (France)



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SESSION-8, HALL-6 / OTURUM-8, SALON-6 • MODERATOR: Nodar Sulashvili		
TITLE	AUTHORS	AFFILIATION
The Manifestation of Features of Factors Effect on Dental Hygiene, Oral Health and Dental Education of Common People	<ul style="list-style-type: none"> • Nodar Sulashvili • Tamar Okropiridze • Nana Gorgaslidze • Luiza Gabunia • Marika Sulashvili • Tamar Sikmashvili 	Tbilisi State Medical University (Georgia)
The Scientific Talks of Manifestation of Peculiarities of Pharmacist Profession, Modern Professional Challenges, Pharmaceutical Sciences, Education, Prospects, Innovations and Society	<ul style="list-style-type: none"> • Nodar Sulashvili • Margarita Beglaryan • Nana Gorgaslidze • Luiza Gabunia • Irine Zarnadze • Marina Giorgobiani • Marika Sulashvili • Diego Rada Fernandez de Jauregui • Igor Seniuk Shalva (Davit) Zarnadze 	Tbilisi State Medical University (Georgia)
Comparative Study of Performance Evaluation of Flow over Crump Weir Using Data-Driven Models	<ul style="list-style-type: none"> • Sani Yakubu Khalifa • Babatunde Korode Adeogun • Abubakar Ismail • Morufu Ajibola Ajibike • Muhammad Mujahid Muhammad 	Ahmadu Bello University (Georgia)
Heat Transfer Performance of Hybrid Nanofluid Through Separation-Flow Passage	<ul style="list-style-type: none"> • Mohamad Jamal • Kazi, Salim Newaz • Hamid, Mahar Diana 	Univesity of Malaya (Malaysia)
Parasitoid-host Interactions Between a Darwin Wasp and its Wood Boring Beetle Larval Host	<ul style="list-style-type: none"> • Iqra Maqbool • Harvinder Kaur Sidhu • Amir Maqbool • Aijaz Ahmad Wachkoo 	Desh Bhagat University Fatehgarh Sahib (India)
Elimination of Inorganic Aqueous Effluents with the Use of Cheap Bio-Adsorbents Hybrid	<ul style="list-style-type: none"> • Djellouli Amir • Berredjem Yamina • Hattab Zhou • Guesmia Hadjer • Yagoub Mohamed • Azri Naima 	• Université mohammed chérif mesaadia de Souk-Ahras (Algeria)
Online Nipost Delivery And Tracking System	<ul style="list-style-type: none"> • Sali Mohammed Bobboi • Sulaiman Ahmad • Raymond Dangdat Delmut • Ali Abubakar 	• Federal Polytechnic Kaltungo (Nigeria)
Trust based Security Scheme for Wireless Sensor Networks	<ul style="list-style-type: none"> • S. A. Arunmozhi 	• Saranathan College of Engineering (Nigeria)



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SESSION-9, HALL-1 / OTURUM-9, SALON-1 MODERATOR: Şebnem Ertaş Beşir		
TITLE	AUTHORS	AFFILIATION
Post-Covid-19 With a Retrospective Approach: Restaurant Spaces in Türkiye	<ul style="list-style-type: none">• Büşra Selin Kepenek• Şebnem Ertaş Beşir	Akdeniz University (Türkiye)
A Competition Journey: Turkish Republic Presidential Symphony Orchestra Concert Hall and Choir Study Building	<ul style="list-style-type: none">• Cüneyt Kurtay• Buse Aysel Aslan	Baskent University (Türkiye)
Analysis and Interpretation of the Istanbul Naval Museum	<ul style="list-style-type: none">• Cüneyt Kurtay• Öykü Güney	Baskent University (Türkiye)
Istanbul's Housing Crisis in the Post-COVID Era: Considering Alternative Solutions	<ul style="list-style-type: none">• Özge Erbaş Melis	İzmir Kâtip Çelebi University (Türkiye)
Investigation of Hacı Ali Ağa Mansion in the Context of Researching Traditional Sille Houses in Terms of Plan and Material	<ul style="list-style-type: none">• Ceren Asilkan• Ceren Güneş• Fatma Seda Çardak	Adana Alparslan Türkeş Science and Technology University (Türkiye)
Suggestions for Hospitals' Interior Design Strategies with Evidence-Based Design (EDB) Approach: Patients Point of View	<ul style="list-style-type: none">• Şevkiye Merve Taşoz	Bahçeşehir University (Türkiye)
Restoration Proposal for the Wooden Door Wings of Diyarbakır Behram Pasha Mosque	<ul style="list-style-type: none">• Fikret Bademci	Kahramanmaraş İstiklal University (Türkiye)
Furniture Design Course Studio Study: Lightweight Furniture Design	<ul style="list-style-type: none">• Şebnem Ertaş Beşir• Abdullah Hikmet Başaytaç• Büşra Göküz	Akdeniz University (Türkiye)



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TITLE	AUTHORS	AFFILIATION
The Concept of Values in Protected Areas: A Cross-Cultural Research	<ul style="list-style-type: none">• Meryem Bihter Bingül Bulut• Tuğba Üstün Topal• Öner Demirel	Kırıkkale University (Türkiye)
The Landscape Protection Plan in Wetland Areas with Geodesign Approach: Uluabat Lake, Türkiye	<ul style="list-style-type: none">• Buse Nur Çırak• Sara Demir Alp	Bursa Technical University (Türkiye)
Designing the Earth's Water Cycle Model: Applications in Education	<ul style="list-style-type: none">• Dang Van Quang• Phan Thi Yen	Technical University of Darmstadt (Germany)
Housing cooperatives in Europe as a form of Social Enterprise	<ul style="list-style-type: none">• Ruslan Martinov	Trakia University (Bulgaria)
Pentecostal Churches Site Selection And Environmental Realities in Delta State: Misunderstandings and Mistakes	<ul style="list-style-type: none">• Favour C. Uroko• George C. Nche	University of Nigeria (Nigeria)
Evaluation of Nevşehir City Center in Terms of Barrier-Free Landscape Design	<ul style="list-style-type: none">• Ahmet Alperen Dikici• Meliha Aklıbaşında	Nevşehir Hacı Bektaş Veli University
Genetic Diversity Analysis and Biological Activity of Natural Populations of <i>Euphorbia Resinifera</i> O. Berg in Morocco	<ul style="list-style-type: none">• Hassane Abd-Dada• Said Bouda• Abdelmajid Haddioui	Sultan Moulay Slimane University (Morocco)
Parameters to Suitable Land Selection for Urban Agriculture'	<ul style="list-style-type: none">• Duygu Doğan• M. Bihter Bingül Bulut	Pamukkale University (Türkiye)



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SESSION-9, HALL-3 /OTURUM-9, SALON-3 MODERATOR: Ebru Doğan		
TITLE	AUTHORS	AFFILIATION
Re-functioning Suggestions for Containers Used After Disasters	<ul style="list-style-type: none">• Zeynep Sena Seven• Ebru Doğan	Malatya Turgut Özal University (Türkiye)
Imperfection in Architecture	<ul style="list-style-type: none">• Didem Sağlam	Istanbul Technical University (Türkiye)
Nature-based Solutions in Sustainable Architecture and Investigation of Their Use in Traditional Housing Textures	<ul style="list-style-type: none">• Yaşar Subaşı Direk	Van Yuzuncu Yıl University (Türkiye)
The Importance of the Concept of Privacy in Traditional Turkish Houses and Its Impact on Architectural Plan Design	<ul style="list-style-type: none">• Hüseyin Zülfikar• Mahsa Hakki	İstanbul Sabahattin Zaim University (Türkiye)
Examining the Concept of Place-Making: The Case of Bursa Cumhuriyet Street	<ul style="list-style-type: none">• Mahshid Mikaeili• Volkan Müftüoğlu	Bursa Technical University (Türkiye)
Degeneration of the Nest Concept: Changes in Peoples Housing Tendencies	<ul style="list-style-type: none">• Lütfiye Yılmaz	Yeni Yuzyil University (Türkiye)
The Effect of Color Element on Visual Perception in Architectural Spaces	<ul style="list-style-type: none">• Mahsa Hakki• Hüseyin Zülfikar	İstanbul Sabahattin Zaim University (Türkiye)
Rising Beyond Challenges: Empowering the Urban Poor with Affordable and Ecological Hillside Housing Solutions Amidst Slopes and Risks in Pahartali, Chattogram	<ul style="list-style-type: none">• Faria Binte Hafiz	Shahjalal University of Science and Technology (Bangladesh)



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TITLE	AUTHORS	AFFILIATION
Digital Transformation in Urban Landscape Areas: The Integration of Technological Innovations and Their Contributions to User Interaction	<ul style="list-style-type: none">• Ayşe Gülnur Gül• Murat Akten	Süleyman Demirel University (Türkiye)
Investigation of the Effect of the Sandplay Therapy in the Open Area	<ul style="list-style-type: none">• Büşra Zelcek• Sima Pouya	İnönü University (Türkiye)
Sensory Garden Design Proposal for Children with Autism Spectrum Disorder	<ul style="list-style-type: none">• Enesnur Bayındır• Sima Pouya	İnönü University (Türkiye)
Walkability in Urban Design: The Case of Burdur-İstasyon Street	<ul style="list-style-type: none">• Ayşen Çoban	Burdur Mehmet Akif Ersoy University (Türkiye)
Analysing the Existing Legislation in terms of Planning and Design of School Spaces of the Ministry of National Education	<ul style="list-style-type: none">• Sibel Akten• Atıla Gül	Süleyman Demirel University (Türkiye)
Evaluation of Historical Urban Landscape in Defining Urban Identity: Example of Gallipoli	<ul style="list-style-type: none">• Elvan Ada	İstanbul Galata Üniversitesi (Türkiye)
Importance and Sustainability of Cultural Heritage Assets of Döşemealtı Region (Antalya)	<ul style="list-style-type: none">• Fadime Öncü• Atıla Gül	Süleyman Demirel University (Türkiye)
Natural Disaster Management Guide for Ornamental Plant Nurseries	<ul style="list-style-type: none">• Hakan Leventoğlu• Atıla Gül	Süleyman Demirel University (Türkiye)



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TITLE	AUTHORS	AFFILIATION
Thiolated Carbon Nanohorn as Sensing Layers for Surface Acoustic Wave Hydrogen Sulphide Sensor	<ul style="list-style-type: none"> • Bogdan-Catalin Serban • Octavian Buiu • Marius Bumbac 	National Institute for Research and Development in Microtechnologies-IMT Bucharest (Romania)
Thiolated Carbon Nanoparticles as Sensing Layer For Resistive Hydrogen Sulphide Sensor	<ul style="list-style-type: none"> • Bogdan-Catalin Serban • Octavian Buiu • Marius Bumbac 	National Institute for Research and Development in Microtechnologies-IMT Bucharest (Romania)
New Surface Acoustic Wave Carbon Dioxide Sensor	<ul style="list-style-type: none"> • Bogdan-Catalin Serban • Octavian Buiu • Marius Bumbac 	National Institute for Research and Development in Microtechnologies-IMT Bucharest (Romania)
Novel Resistive Relative Humidity Sensor	<ul style="list-style-type: none"> • Bogdan-Catalin Serban • Octavian Buiu • Marius Bumbac 	National Institute for Research and Development in Microtechnologies-IMT Bucharest (Romania)
Carbon Nanohorns -Based Matrix Nanocomposite for Cd (II) and Hg (II) Removal from Wastewater	<ul style="list-style-type: none"> • Bogdan-Catalin Serban • Octavian Buiu • Marius Bumbac 	National Institute for Research and Development in Microtechnologies-IMT Bucharest (Romania)
Vietnam's Policy on CO₂ Emissions in the Context of Accessing International Agreements	<ul style="list-style-type: none"> • Minh Le Thi 	Thu Dau Mot University (Vietnam)
Floating Market Culture in Can Tho-Vietnam	<ul style="list-style-type: none"> • Pham Duc Thua • Pham Thi Phuong Linh 	Can Tho University (Vietnam)
The Role of Blockchain Technology in Promoting Circular Economy Development	<ul style="list-style-type: none"> • Nguyễn Khánh Hùng • Huỳnh Minh Quân 	Thu Dau Mot University (Vietnam)



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TITLE	AUTHORS	AFFILIATION
BIM-supported Cross-Curricular Facilities Management Training for AEC Students	<ul style="list-style-type: none">• Salih Ofloğlu	Antalya Bilim University (Türkiye)
A Review of Postgraduate Programs for Project and Construction Management Education	<ul style="list-style-type: none">• Murat Aydın	Ankara University (Türkiye)
Not Complying with the Knowledge of the Technique in Representation: A Reading on the Secret of Kells	<ul style="list-style-type: none">• Hande Asar	Ondokuz Mayıs University (Türkiye)
How to Define Social Sustainability in Architecture	<ul style="list-style-type: none">• Elif Ulu• Şeyda Emekci	Ankara Yıldırım Beyazıt University (Türkiye)
Perception or Illusion: Exploring the Dynamics of Visual Interpretation	<ul style="list-style-type: none">• Elif Çelik Kaya• Dilara Berk Coşkun	Yıldız Technical University (Türkiye)
A Comprehensive Analysis of General Trends in Thesis Literature Concerning Place Attachment	<ul style="list-style-type: none">• Selin Alıcı İnci• Ayşen Özkan	Ondokuz Mayıs University (Türkiye)
Crowdsourcing Based Project Application, Impact on Architecture Students	<ul style="list-style-type: none">• Melih İpçioğlu	Eskişehir Osmangazi University (Türkiye)
In Situ Design for Context Awareness: Extended Reality	<ul style="list-style-type: none">• Faruk Can Ünal	Yeditepe University (Türkiye)



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TITLE	AUTHORS	AFFILIATION
An Innovative and Sustainable Practice in Urban Green Spaces: Edible Landscape Practices	<ul style="list-style-type: none">• Demet Demiroğlu• Endam Özkaya	Kilis 7 Aralık University (Türkiye)
Common Motifs in Turkish Art and Mongolian Art	<ul style="list-style-type: none">• Marzie Parvaresh Rizi	Dokuz Eylül University (Türkiye)
Personification of Mundane Objects: A Sense of (an) Other	<ul style="list-style-type: none">• Şerife Zeynep Özcan	Dumlupınar University (Türkiye)
Exploring the Role of Contextual Factors and Metaphors in Architectural Envelope Formation	<ul style="list-style-type: none">• Dilara Berk Coşkun• Elif Çelik Kaya	Yıldız Technical University (Türkiye)
Discussing the Concept of Multi-Sensory Space Through the Theory of Sensory Integration	<ul style="list-style-type: none">• Kübra Malçok• Bilge Sayıl Onaran	Selçuk University (Türkiye)
Impact of Break Space Characteristics on the Autonomic Nervous System and the Study Performance: An Experimental Study	<ul style="list-style-type: none">• Abdulrahim Umar Darma• Maryam Arshadi• Sena Cumurcu• Burçin Mızrak Bilen	Ozyegin University (Türkiye)
Utilizing Gamification Strategies as a Pedagogical Framework for Architectural Design Studio	<ul style="list-style-type: none">• Mehmet Sarper Takkeci• Arzu Erdem	İstanbul Technical University (Türkiye)
Use of Color in Cinematic Space in the Example of the Film "Lara" (2009)	<ul style="list-style-type: none">• Tane Doğan	İstanbul Galata University (Türkiye)



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SESSION-10, HALL-3 / OTURUM-10 SALON-3 MODERATOR: Cengiz Yücedağ		
TITLE	AUTHORS	AFFILIATION
Evaluation of Promenades in Isparta City Center in Terms of Recreational Use	<ul style="list-style-type: none">• İshak Ertaş• Cengiz Yücedağ	Burdur Mehmet Akif Ersoy University (Türkiye)
A Systematic Review of Postgraduate Theses on Architectural and Urban Design Competitions in Türkiye	<ul style="list-style-type: none">• Murat Çağlar Baydoğan	Erciyes University (Türkiye)
Bibliometric Analysis of Studies on Urban Landscape Concept	<ul style="list-style-type: none">• Ahmet Erkan Metin• Atıla Gül	Uşak University (Türkiye)
Investigation of Thermal Hotels in terms of Landscape Design: The Case of Afyonkarahisar	<ul style="list-style-type: none">• Betül Çakır• Bora Bingöl	Burdur Mehmet Akif Ersoy University (Türkiye)
Use of Parks by Disadvantaged Individuals: Case of Antalya-Dokumapark, Türkiye	<ul style="list-style-type: none">• Hatice Bütüner Çetin• Cengiz Yücedağ• Nuray Çiçek	Burdur Mehmet Akif Ersoy University (Türkiye)
The Role and Importance of Municipalities in Earthquake Disaster Risk and Crisis Management	<ul style="list-style-type: none">• Atıla Gül• Hüseyin Keçer	Süleyman Demirel University (Türkiye)
Isparta University of Applied Sciences Central Rectorate Building Plant Design	<ul style="list-style-type: none">• Sibel Akten• Musa Yasin Torun	Isparta University of Applied Sciences (Türkiye)
Examination of Authentic Restaurants in Hotels in Terms of Interior Design	<ul style="list-style-type: none">• Fikri Berk Soner• Şebnem Ertaş Beşir	Akdeniz University



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Ankara Time 17:30-19:30		
SESSION-10, HALL-4 /OTURUM-10, SALON-4		
MODERATOR: Ertan Düzgüneş		
TITLE	AUTHORS	AFFILIATION
Design Principles of the Amsterdam School	• Seylan Öztürk	Marmara University (Türkiye)
Architectural Analysis of Late Period Quarantine Structures in The Red Sea: Kamaran Quarantine Station	• Aylin Gazi Gezgin	Ministry of Culture and Tourism (Türkiye)
The Perception of Haze Formed on Urban Reinforcement Elements	• Dilek Kul • Alper Sağlık	Çanakkale Onsekiz Mart University (Türkiye)
Evaluation of Hydrological Processes in the Gala Lake National Park Basin Using the SWAT Model	• Emine Keleş • Enes Ozgenc	Trakya University (Türkiye)
Evaluations of the Session of House of Commons of United Kingdom on the War After the Gallipoli Landing	• Çağdaş Yüksel	Pamukkale Üniversitesi (Türkiye)
Examination of Amasya University Hakimiyet Campus' Potential to Become a Sustainable and Green Campus	• Sultan Sevinç Kurt Konakoğlu • Kadir Tolga Celik	Amasya University (Türkiye)
Biophilic Urban Oasis: Green Roof Design Solutions for Istanbul's Concrete Jungle	• Ayşe Gül Gemici	Istanbul Sabahattin Zaim University (Türkiye)
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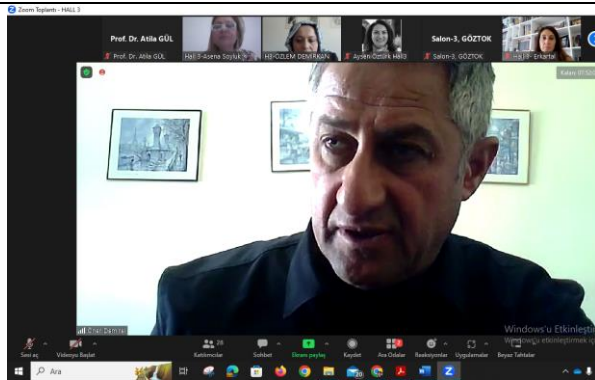
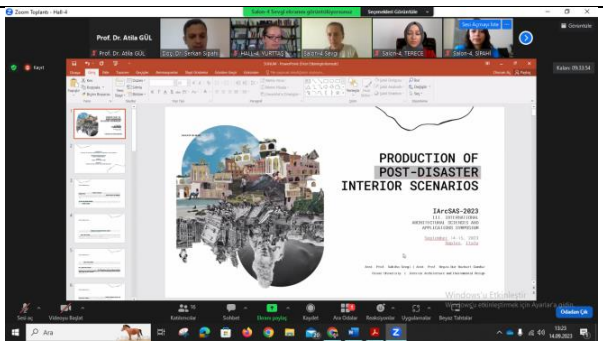
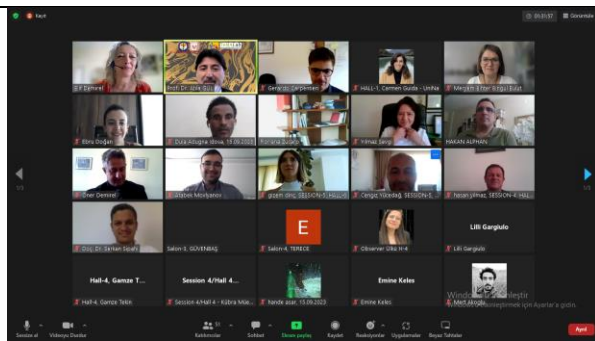
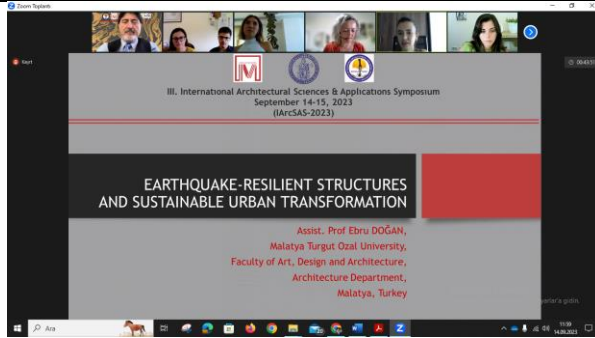
FRIDAY - 15.09.2023 Ankara Time 17:30-19:30		
SESSION-10, HALL-5 / OTURUM-10, SALON-5 MODERATOR: Çağla Aydemir		
TITLE	AUTHORS	AFFILIATION
Effects of Fieldwork Strategy on Senior Secondary School Students Academic Performance and Interest In Geography, Katsina, Nigeria	<ul style="list-style-type: none"> • Ahmed Tukur • Salisu Aminu • Abdulkadir Ndatsu 	Federal University of Technology (Nigeria)
Marketing of Fashion with the Help of Sustainability	<ul style="list-style-type: none"> • Akhtarul Islam Amjad • Mohd. Vaseem • Nikita 	Department of Fashion Technology (Nigeria)
Response in Mitigating Environmental Damage and Mis-Management Caused From Emergencies and Disasters.	<ul style="list-style-type: none"> • Ganya, Adamu Hauni • Dauda, Hauwa • Ango, Monica 	Usmanu Danfodiyo University (Nigeria)
Peran Digital Marketing Terhadap Peningkatan Pendapatan Umkm Alam Tani Hydrofarm Di Kudus	<ul style="list-style-type: none"> • Donna Laili Octaviana • Ryan Andni 	Institut Agama Islam Negeri Kudus (Nigeria)
A New Approach for Colorization and Resolution Improvement of Images	<ul style="list-style-type: none"> • Vaibhav Kant Singh 	Central University (Nigeria)
Labor Markets and Business Regulations in Central and Eastern European States	<ul style="list-style-type: none"> • Laura Diaconu (Maxim) • Cristian C. Popescu • Mihai-Bogdan Petrisor 	University of Iasi (Romania)
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SYMPOSIUM PHOTOS

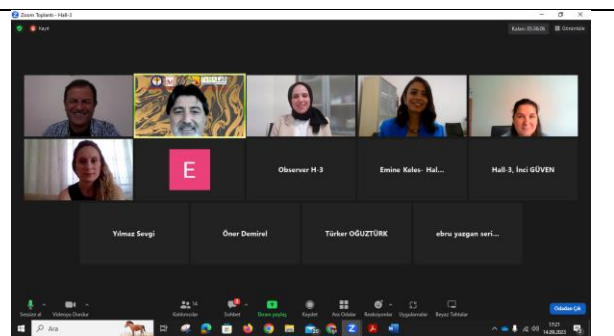
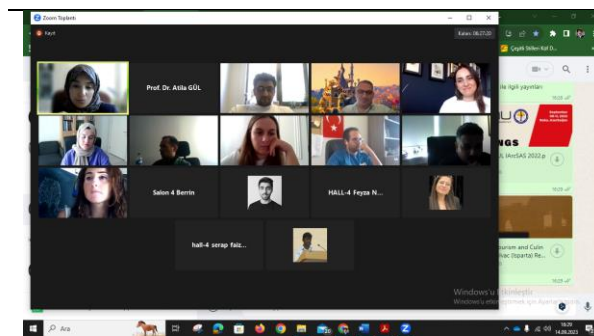
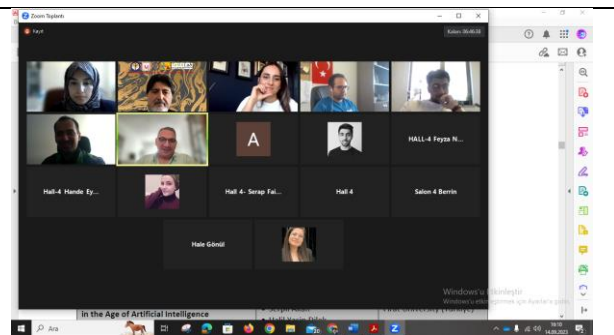
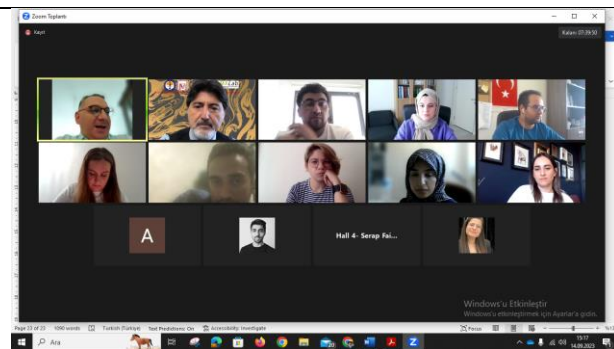
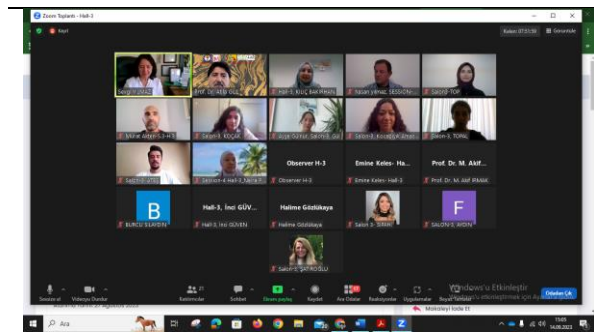
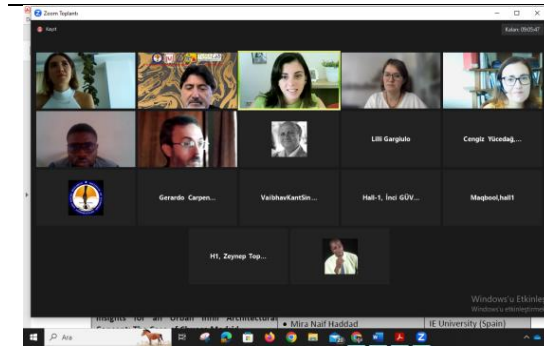




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Visual Comfort And Illumination Within Mosques

- Sacred architectural environments wield the potency to evoke profound emotional and physiological responses in individuals, allowing for the orchestrated interplay of symbolic and material constituents in spatial configuration. These edifices primarily facilitate worship and spiritual practices among adherents united by shared convictions and sentiments.




Figure 8: Visual Comfort and Illumination Within Mosques

- In this context, the seamless alignment of the philosophical underpinnings of faith with the tangible architectural parameters is paramount, as it engenders a cohesive conduit for the nuanced transmission of abstract tenets into illustrative form. Illustratively, the diffusion of natural light through fenestral apertures encircling the dome within mosques not only furnishes requisite luminosity to enable visual discernment, but also exerts a congregative influence, coaxing to converge beneath the dome while augmenting the perceptual richness of its encompassing space (Kocoguz, 2023). This intrinsic harmony between the enduring cultural ethos and the intricacies of illumination design

3RD INTERNATIONAL ARCHITECTURAL SCIENCES AND APPLICATIONS SYMPOSIUM September 14-15, 2023 / Naples, ITALY

ROUTES AND TRACES: THE ROLE OF CONSTRUCTION MATERIALS IN SHAPING THE PEDESTRIAN-FRIENDLY URBAN ENVIRONMENT

ÖRÜN BİÇER, ASSIST. PROF. DR., İSTANBUL BEYKENT UNIVERSITY, TÜRKİYE
SERKAN ERİNGÜ, ASSIST. PROF. DR., İSTANBUL BEYKENT UNIVERSITY, TÜRKİYE

3RD INTERNATIONAL ARCHITECTURAL SCIENCES AND APPLICATIONS SYMPOSIUM

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3rd International Architectural Sciences and Applications Symposium
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Discussions of Building

Cosmos Mission located between Bey and 25th/26th neighborhoods of Istanbul, the western part of Turkey, was built in 1976. It is an example building made of cast concrete frames which consists of non-continuous and low height. There are deep under ground carpark on the ground floor of Cosmos Mission. It is a residential area next to the center of the Mission. There are underground spaces around the building. The building is in the high layer received the sunlight of the tower is oriented towards a road which door. It is a decorative facade providing entrance. With its singular pediment and profile facade makes the building have a characteristic architectural setting.



The Advantages of Using Biodegradable and Eco-friendly Materials in Construction

İsmailoğlu İsmail Güllü
M.Sc. Student
Aldemiriz University

Prof. Niyazi Uğur Koçak
Aldemiriz University




The Advantages of Using Biodegradable and Eco-friendly Materials in Construction

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Aldemiriz University


Sustainable construction

- It means building with renewable and recyclable resources and materials.
- During construction projects, care must be taken to reduce waste and energy consumption where possible and protect the natural environment around the site.



But...

6 February 2023

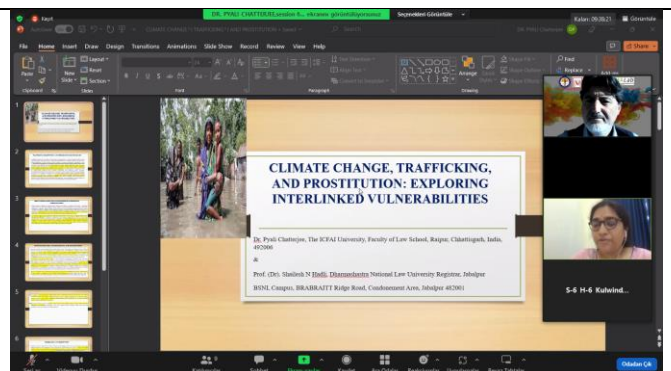
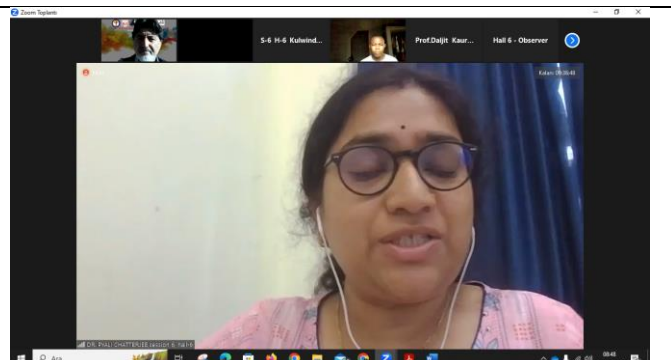
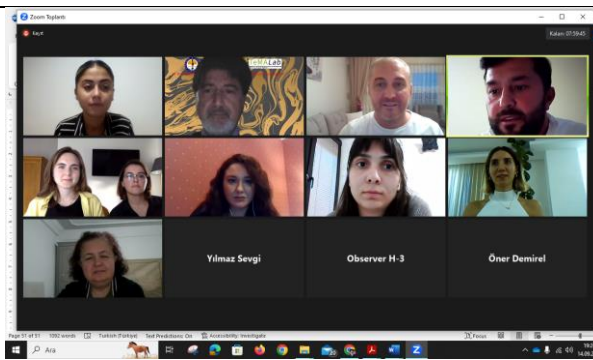
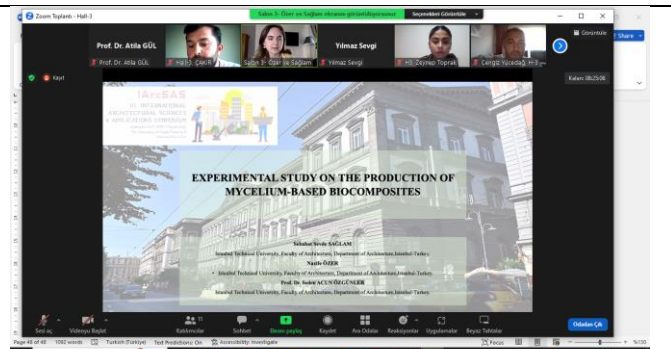
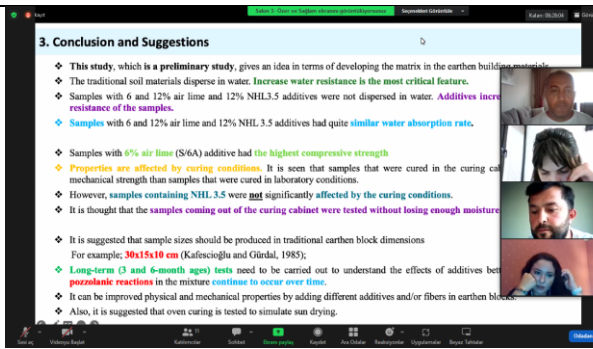
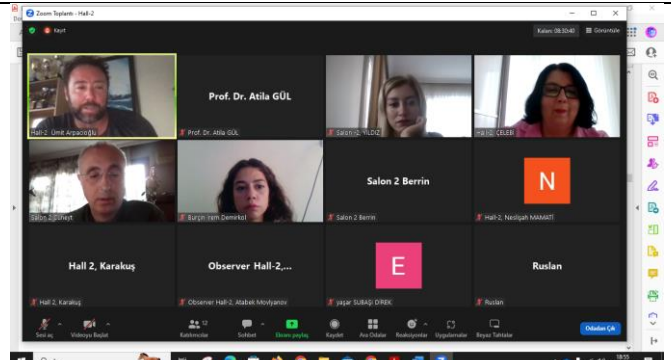
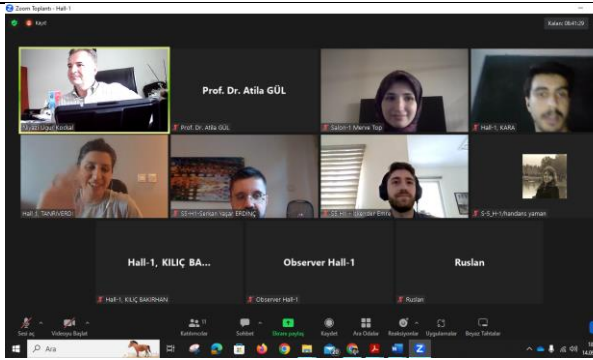




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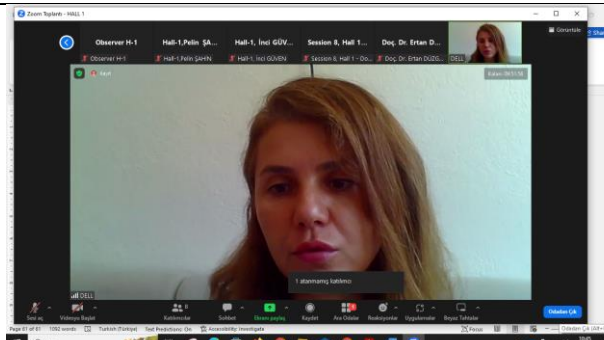
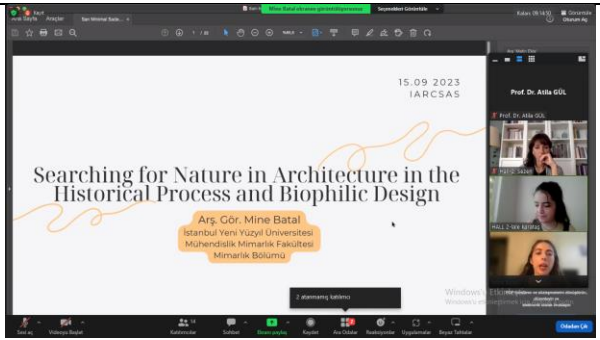
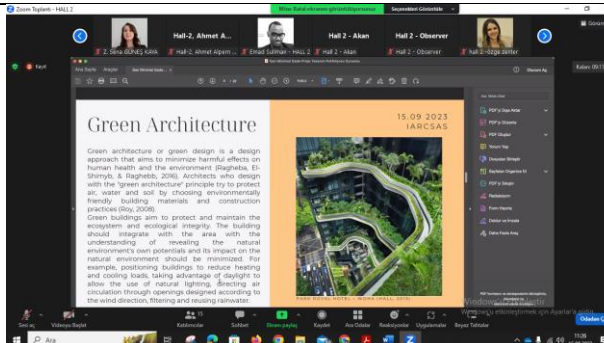
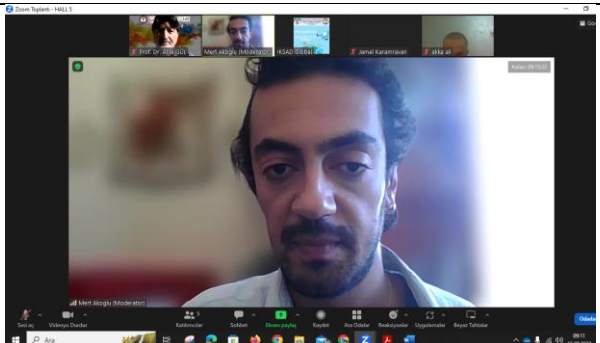
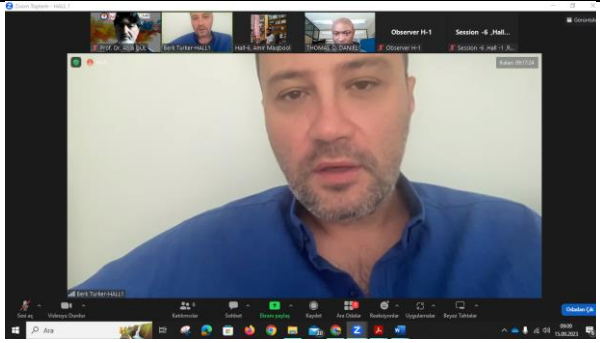




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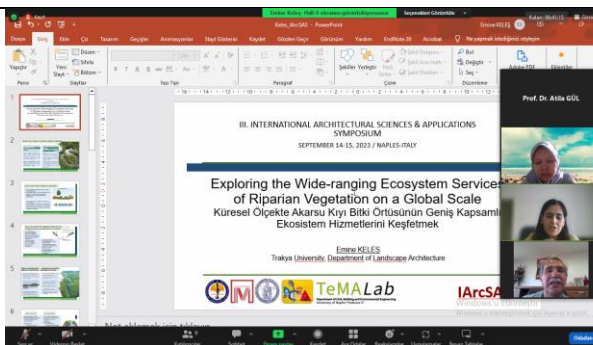
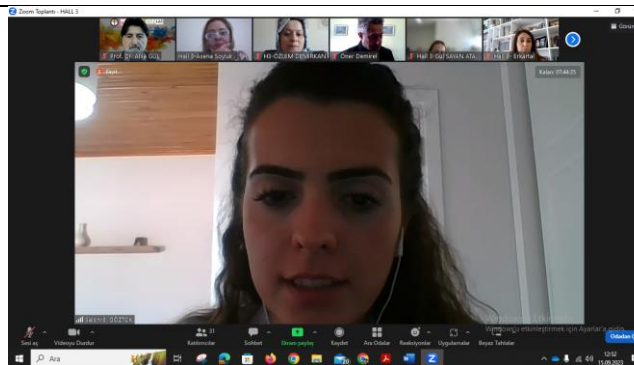
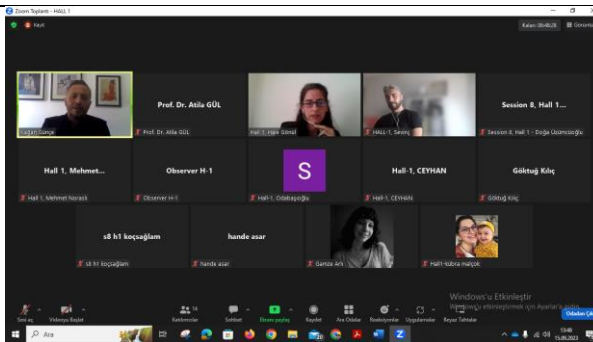
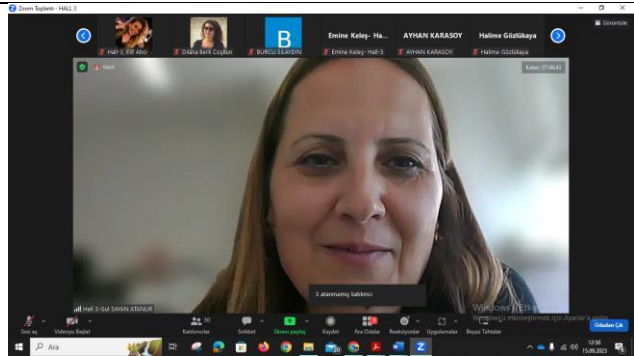
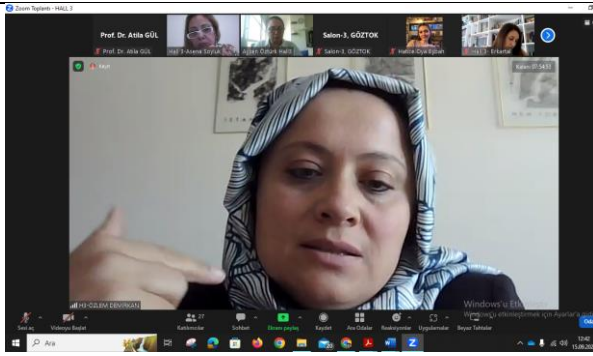




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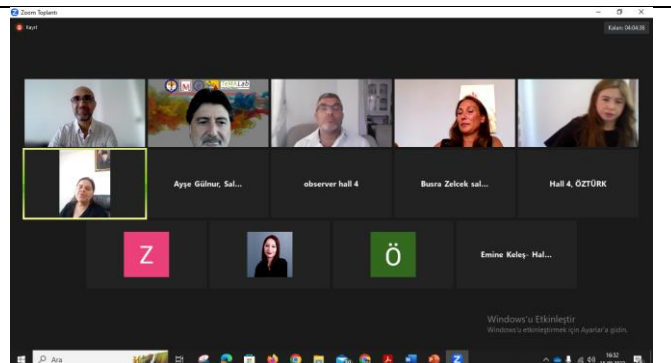
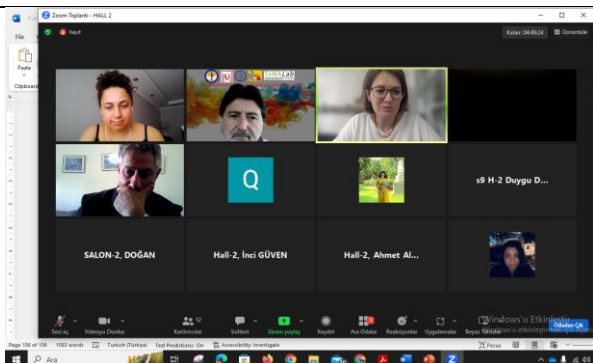
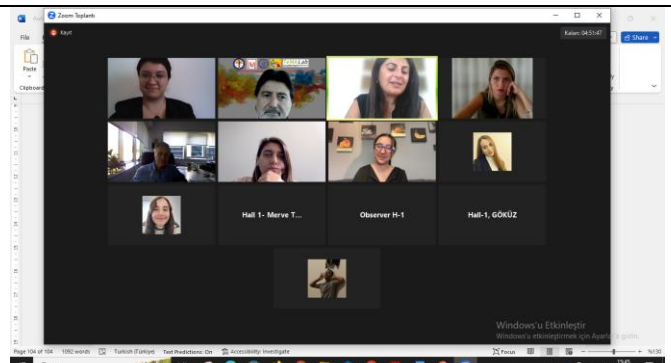
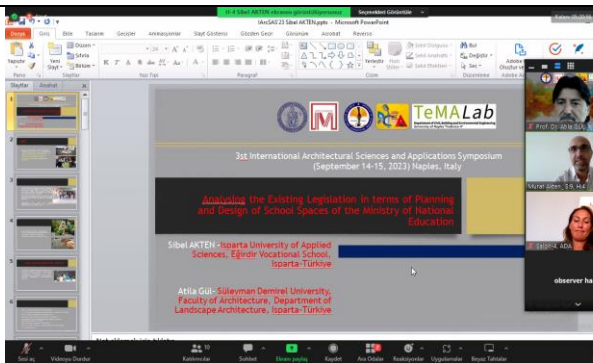
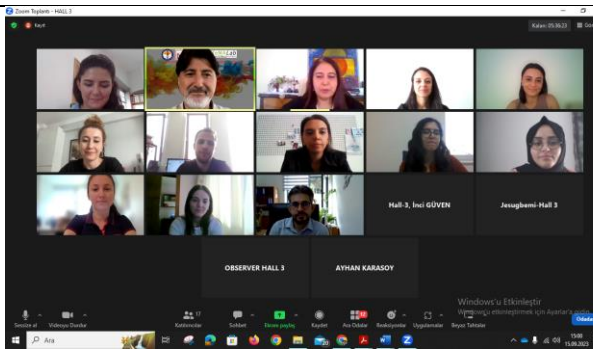
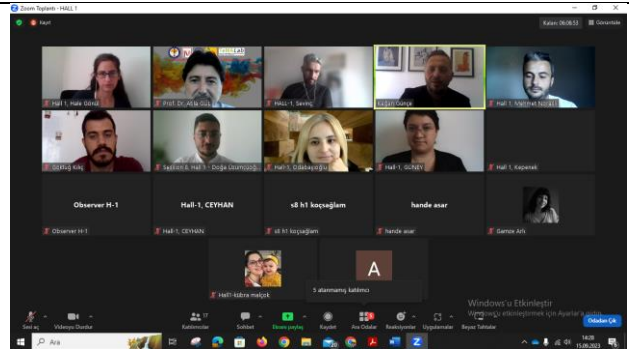
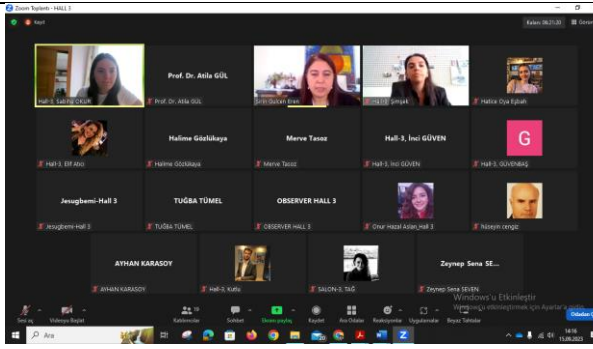
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Introduction:

- Süs bitkileri farklı yöntemler kullanılarak üretilir, dikiltiler ve iklimsel amaçlarla tarımın, çoğaltım ve büyütmeye bitkiler olarak tanımlanabilir.
- Bu tanımdan anlaşılacağı üzere süs bitkileri kapsamı ve üretimi yepyeni çağ geniş bir açıktır. Bu süreç tarımsal ve ekolojik gelişimden başlayarak, her yıl daha fazla hacmini daha da genişletmektedir.
- Ayrıca üreticilerin ve tarım faaliyetleri bakımından iklimsel ekolojisi ve doğal varlıkların uygun bilimsel ve coğrafi koşulları, pazar likvidite yanıklığı ve ucuz işçilere sahip olması gibi önemli avantajlara sahiptir.

Ornamental plants can be defined as plants that are produced, propagated and grown for aesthetic, functional and economic purposes using different methods. As can be understood from this definition, ornamental plants are a sector with a very wide scope and production range. This sector expands its foreign trade volume every year depending on agricultural and sectoral developments.

In addition, in terms of cultivation and production activities, our country has important advantages such as its ecology and natural assets, suitable climatic and geographical conditions, proximity to market countries and cheap labor force.

Phase 3: 3D Coordination and Project Management
(MKE542 and ISM/7084 courses)

- Developing MEP (Mechanical Electrical Plumbing) for assets with external support from the industry
- Construction management by engineering students: 3D coordination, 4D/5D modeling in BIM software
- Placing final models to the Published area of the CDE.

Software: Autodesk Revit, Autodesk Navisworks

1. Introduce

- Dünya var olduğundan bugüne kadar deprem, sel, erozyon, toprak kayması, kasırga gibi doğal süreçler her zaman gerçekleşmiş ve gerçekleşecektir. İnsanın çok yönlü faaliyetlerinin doğal süreçlerle uyumlu olmaması, zarar verici yaklaşımlarının olması ve gerekli tedbirleri almaması gibi nedenlerle söz konusu doğal süreçler can ve mal kaybına yol açarak doğal afetlere dönüşmektedir.
- Natural processes such as earthquakes, floods, erosion, landslides and hurricanes have always occurred and will always occur
- These natural processes turn into natural disasters by causing loss of life and property due to reasons such as the incompatibility of human versatile activities with natural processes, having damaging approaches and not taking necessary measures.

Sonuçta Doğal afetler insan kaynaklı bir sonuçtur. As a result, natural disasters are a human-induced result.

Kilise Sahneleri

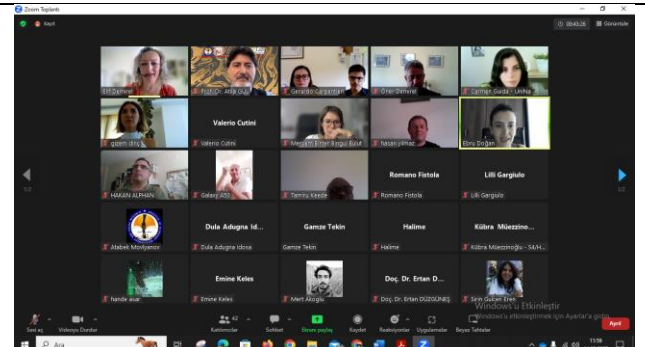
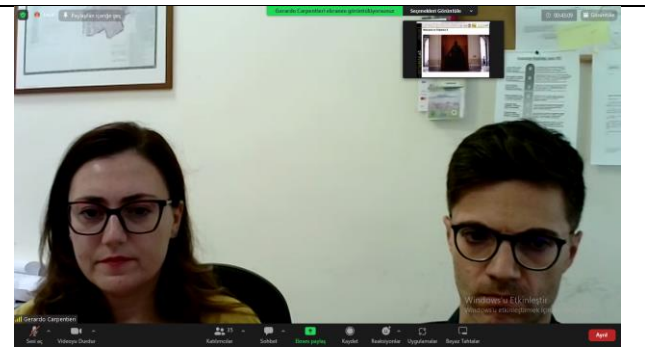
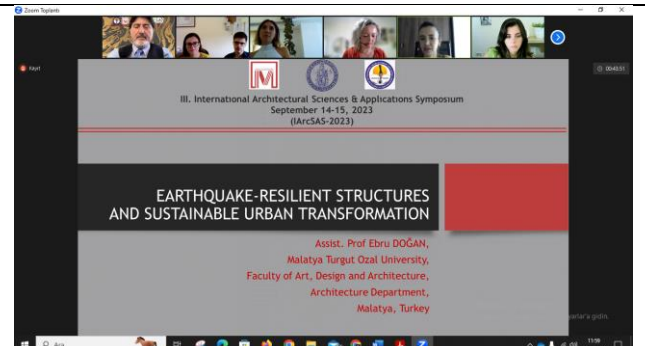
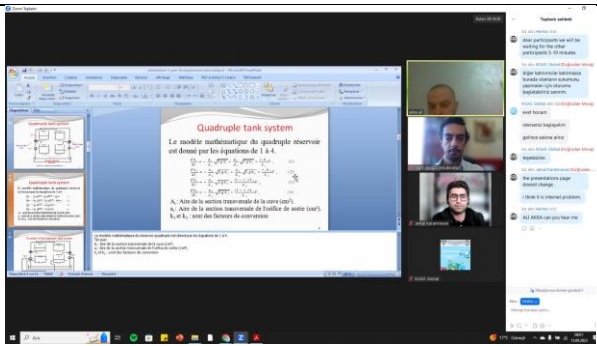
Bu sahneler bu "ijonizasyon" alanında önemli bir rol oynayabilir. Bu sahne mekan ritüelleri insanları bilgilendirir ve müdahale "hatalarıyla" önlenir değildir. Hataların önlenmesi için doğru bir şekilde yapılan yaklaşımların önemi belirler.



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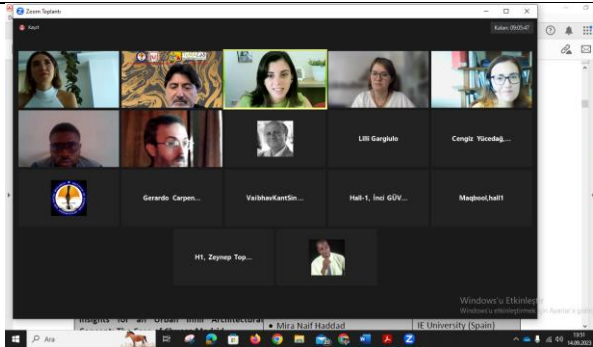
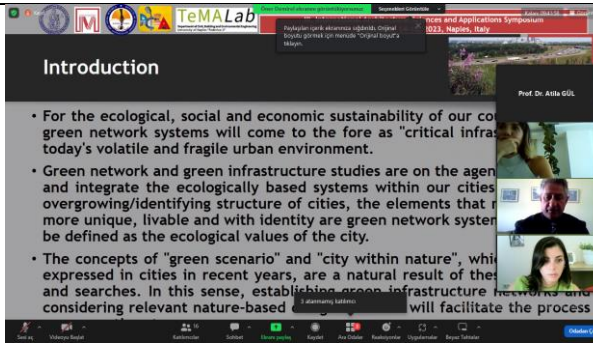
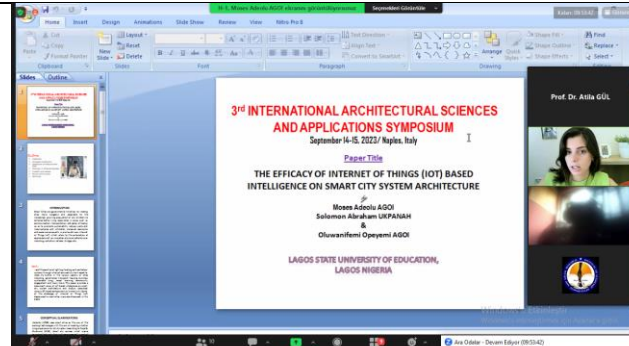
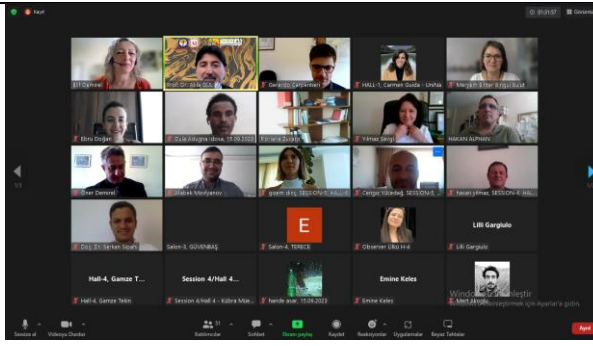
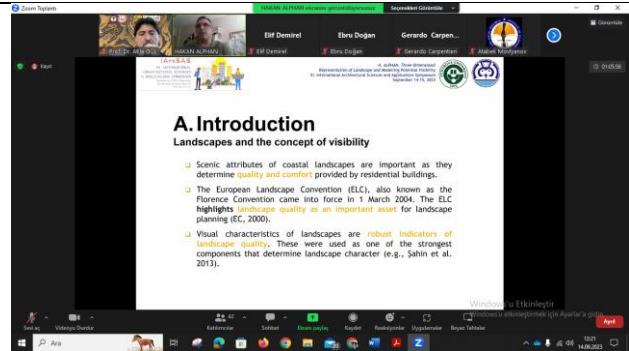
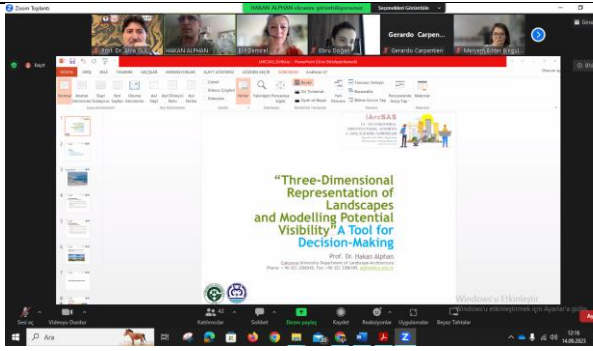
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PROCEEDINGS BOOK (Abstracts)

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THE POTENTIAL OF URBAN OPEN SPACES WHEN COPING WITH CLIMATE CHANGE EFFECTS

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ABSTRACT

In the face of unprecedented and potentially extreme climate change, urban open spaces may not have the same capacity to adapt. In this context, planned adjustments to “business as usual” are becoming relevant to lead to effective adaptation measures, explicitly influencing urban adaptation planning and interventions. In fact, urban open spaces represent a flexible infrastructure including different urban spaces (i.e., squares, green urban areas, gardens, paved areas), vital to urban resilience and quality of life. In this perspective, this paper is oriented toward answering the following research question: how to transform the open space system to adapt it to climate change and increase urban resilience? For this purpose, we provide a method to support local decision-makers in the definition of appropriate and efficient adaptation, reorganization, and reuse interventions, according to their physical and urban context characteristics, as well as the needed costs and the likely positive effects.

Keywords: Climate Change Adaptation, Urban Planning, Open Spaces, Green Spaces.



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MARKETING OF FASHION WITH THE HELP OF SUSTAINABILITY

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ABSTRACT

Shapes, designs, and styles are continuously changing and fashion is constantly evolving. Yet the term sustainability, is not as common in the global fashion industry as it is in other manufacturing industries. Sustainability in the textile and clothing sectors impacted by several stages such as raw material, manufacturing process, supplychain and product lifecycle. Many international fashion brands and designers use innovative sustainable fabrics to differentiate their brands and appeal to consumers which are manufactured with the innovative sustainable alternative fibers in respect to the conventional fibres. These innovative sustainable fibres can be organic, biodegradable, recyclable, eco-friendly, highly functional with the extent of product life span. In compare to conventional cotton, organic cotton uses 62% less energy and 88% less water overall and is grown without the use of pesticides or synthetic fertilisers. Cork fabric has gradually found its way in the fashion industry instead of stopper for wine bottles. Since hemp absorbs more carbon dioxide from the atmosphere than the average plant, it is regarded as a raw material with negative carbon emissions. TENCEL, Lenzing's trademark lyocell is made with a closed-loop system that recycles 99.5% of the solvents used during production. Apple leather, also known as Frumat or Pellemela, is made from waste materials from the apple juice industry. Qmilk is a milk protein and casein fibre by-product of the dairy industry. The ethical shoe company Po-Zu, based in London, makes its products by hand sewing organic cotton and Pinatex (leather made from pineapple leaf fibres) together without the use of glue. To address these issues, numerous Indian brands and designers have adopted sustainable practises in recent years. The sustainable fashion market in India is expected to grow at a CAGR of 10.6% during 2021-2026, according to a report by researchandmarkets.com. The report also suggests that the market's growth will be driven by increased consumer awareness, government initiatives, and the availability of sustainable materials.

Keywords: Ecofriendly, Innovation, Fibres, Textile, Clothing.



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IN SITU DESIGN FOR CONTEXT AWARENESS: EXTENDED REALITY

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ABSTRACT

Context awareness is an important input that should be considered as a priority for any design to be developed. In this study, it is aimed to evaluate the contributions and potentials of extended reality in establishing a relationship with place and space in relation to the field of architectural design. Within the scope of the study, case studies revealed with extended reality were examined. Under the two different scales of place and space, context awareness in terms of the relationship of the building to the place in which it will be located in the future and the interior design of existing spaces are discussed. Being in direct contact with physical reality through extended reality allows architects to go beyond designing with certain data that is reduced after observing a place or existing space. It can be seen that the case studies examined help users to understand the existing data better and identify the problems. As a result, users can develop their architectural designs in situ with the context awareness of the place or space. Considering the rapid development and dissemination of extended reality, it is thought that the in situ design approach will be accepted by architects in future design actions.

Keywords: In Situ Design, Context Awareness, Extended Reality.



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EVALUATION OF HISTORICAL URBAN LANDSCAPE IN DEFINING URBAN IDENTITY: EXAMPLE OF GALLIPOLI

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ABSTRACT

Changing production and consumption patterns due to rapid population growth, industrialization and globalization cause urbanization to increase rapidly. This situation affects not only big cities but also small settlements that have gained urban identity as a result of various functions. That process can be observed more concretely in rural settlements located on the coastline, which has historical urban landscape characteristics that define the identity of the city. Today, social and cultural developments that occur under the influence of globalization create cities that have become ordinary by losing their distinctive characteristics. However, cities have unique identities as memory places of societies that reproduce them throughout history as the product of a developing, transforming and dynamic process. In this context, it is important that urban design processes are designed by taking into account the historical and identity values of the city. Natural landscape features combined with cultural layers in the historical process become an important element that defines the urban identity by creating the historical urban landscape of cities. In this study, Gallipoli, which has been an important settlement since ancient era, was chosen as the research area in order to present an approach in the context of the cultural dimension of the landscape and its relationship with the urban identity. Especially in the city, which has witnessed wars and population exchanges due to its geographical and strategic location, the physical environment shaped by historical and cultural layers and the traces of tangible and intangible cultural heritage appear as elements that define the identity of the city. During the research, the identification of cultural landscape elements that define the urban identity of Gallipoli was documented with the help of visuals obtained through on-site observation method. Cultural landscape elements were followed in the context of traces, regions, nodes and landmarks, which are structural elements in defining the urban identity; it is aimed to provide a reference for the protection, management and planning strategies of Gallipoli's historical urban landscapes.

Keywords: Gallipoli, Historical Urban Landscape, Cultural Landscape, Sustainability, Urban Identity.



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COMMON MOTIFS IN TURKISH ART AND MONGOLIAN ART

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ABSTRACT

In this article, we will examine the notable similarities and shared decorations between Turkish art and Mongolian art. Both Turkish and Mongolian cultures have interacted throughout history and explored similar themes in artistic expressions. Common motifs observed between these two cultures can encompass various areas such as visual arts, decorations, and symbols. One of the most distinct shared motifs in Turkish and Mongolian art is nature and animal figures. Both cultures have coexisted with nature and incorporated artistic expressions reflecting their surroundings. Additionally, geometric motifs are frequently encountered themes in both Turkish and Mongolian handicrafts. These motifs inspired by nature can be seen as an expression of deep respect and attachment to the natural environment. Furthermore, influenced by their nomadic way of life, Turkish and Mongolian cultures exhibit similarities in the use of symbols associated with vehicles and nomadic lifestyles. Tent and nomadic motifs are significant symbols that reflect cultural identity and way of life. This article provides a general overview of common motifs between Turkish art and Mongolian art, and highlights parallels in nomadic life, symbols, and themes present in the artistic expressions of both cultures. These shared motifs stand as significant indicators of the interactions and similarities that Turkish and Mongolian cultures have experienced throughout history.

Keywords: Turkish Art, Mongolian Art, Decoration.



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A SYSTEMATIC REVIEW OF POSTGRADUATE THESES ON ARCHITECTURAL AND URBAN DESIGN COMPETITIONS IN TÜRKİYE

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ABSTRACT

Objective: This study systematically analyzed the postgraduate theses on competitions, considered suitable for spatial productions and generally opened by public institutions in Türkiye. Material and Method: In this retrospective literature review, theses in architecture, urban and regional planning, and landscape architecture between 1990 and 2023 were investigated in which the term competition was used. The inclusion criteria of the theses examined in the database of the National Thesis Centre of the Council of Higher Education (YOK TEZ) were determined as the inclusion of the keywords "architectural design", "urban design", "design", and "idea" under the subtitle "competition". The titles and ABSTRACTs of the theses were searched, and the graduate theses were analyzed in terms of content. After the theses were divided into master's and doctoral theses, they were classified in chronological order and in terms of content. Findings: Out of 76 theses on architectural project competitions at Yök Thesis Center, 66 were master's and 10 were Ph.D. Of the Ph.D. theses, two focused on urban design competitions, and eight on architectural competitions. Nine master's theses were related to urban and regional planning, and one was on landscape architecture. Most theses were written after 2017, except for two in 2008. Two theses analyzed the entire competition and production process. The majority had a methodological problem and did not have concrete results. Turkish theses mainly focused on competitions in Türkiye. Conclusion: It has been observed that discursive practice, carrying conceptual knowledge, reading, interpretation, and including information on methods are generally not at a sufficient level in theses on competitions, which have spatial consequences and are considered necessary for professional practice and architecture-urban design culture. At the same time, it has been determined that academic studies at the postgraduate thesis level are not quantitatively sufficient for architectural design and urban design competitions. In this context, it is recommended to increase the number of studies on competitions, which play an essential role in informal education, make outstanding contributions to architectural culture, and raise awareness. It was observed that the number of theses increased after the periods when competitions entered the architectural agenda, and the number of advertisements increased. The general conclusion is that the relative insufficiency of the number of theses on the subject in our country, where the competition culture in architecture and urban design has not been formed, is proof that this process is not functioning correctly in Türkiye and that there are still question marks in minds due to the selection criteria, jury selection, the creation of specifications, the competition regulations of KİK and TMMOB, the low number of competitions, which is one of the democratic methods, etc.

Keywords: Postgraduate Theses, Architectural Competitions, Urban Design Competitions, Türkiye.



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THE ROLE OF WOODY ECOSYSTEMS IN URBAN AREAS LANDSCAPE ARCHITECTURE

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ABSTRACT

The formation of new types of architectural and urban planning spaces should be based on the study of environmental and social needs among which an important place is occupied by ensuring environmental sustainability, which requires active use of landscaped levels. Due to the trophicity and humidity (hydrology) of the soil, the formation of the main dominant species of trees in forest ecosystems takes place. At the current stage of optimization natural environment after the active phase in the armed conflict and restoration of ecosystems in the Ukrainian Dnieper steppe, as well as in industrial settlements in the Dnipro region, acclimatization of adventitious tree species and monitoring of invasive trees in landscaped ecosystems play an important role. The region of the Kryvyi Rih iron ore basin is characterized by an extremely high level of integration industrial pollution. The leading biological and dendrometric characteristics in the method of feeding artificial woody plantations have a clear environmental condition. Indicators of the viability of artificial tree plantations in Kryvyi Rih depend on the trophic balance of incoming nutrients. They also testify that the significant factors of nutrition are the uneven seasonal soil moisture and the increased level of pollution by dust emissions from quarries, which constantly accumulates on the leaves of trees and the surface of the soil. Thus, the creation of new structures of architectural objects, which determine the nature of interaction with the environment, is impossible without comprehensive consideration of the value and ecological-environmental factors in defined urban environment.

Keywords: Forest Ecosystems, Dnipro Steppe Region, Plants Introducing, Resistance to Growing Conditions, Artificial Woody Plantations.



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REGIONAL ENVIRONMENTAL SAFETY AND ARTIFICIAL WOODY PLANTINGS INTRODUCED IN THE DNIEPER STEPPE (UKRAINE)

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ABSTRACT

Regional environmental safety issues have recently played a special role. Crimes against nature in the future should be considered with special care, since they have negative consequences for human existence in any region. Therefore, the scientific basis of regional environmental safety is necessary for the development of any social projects. The purpose of this work was to consider the value of introduced artificial ancient plantations as one of the key factors in the implementation of sustainable development of the ecological security of the steppe zone of Ukraine at the ecosystem level. The task of the work was to identify and assess the level of negative effects on introduced plants and predict the likely consequences of this process for the composition and structure of vegetation in the region. In order to test the research hypothesis, comparative studies of the current limits of distribution of some adventitious plants, which a few decades earlier were associated only with local thickets, were conducted. Regional ecology studies the natural environment and the impact of society on the nature of local communities ecosystems. Any human activity, whether economic, technical or social, involves interfering with the natural landscape, which leads to a violation of the balance of ecosystems. The task of regional environmental studies is to identify the causes and consequences of such violations and offer solutions to avoid harm to animals and plants. However, some changes may be irreversible. In this case, the task of regional environmental research will be to restore natural ecosystems. It is revealed that some introduced plant species can benefit from survival and settlement on the territory of the Dnieper steppe in the conditions of climate changes in recent decades.

Keywords: Violation of the Balance of Ecosystems, Crimes Against Nature, Value of Introduced Artificial Ancient Plantings.



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IMPACT OF URBAN EXPANSION ON URBAN HEAT: A CASE STUDY OF GREATER LONDON

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ABSTRACT

Urban expansion in several cities have been linked with significant impacts on land surface temperature (LST). In this study, we investigate the impacts of urban expansion on Greater London within the last two decades (2000-2022). Land TRM and OLI_TIRS imageries for years (2000, 2013 and 2022) which was obtained from the USGS earth explorer was used for the study. Using these dataset, we conduct a supervised maximum likelihood classification (LULC), LST and Normalized Differentiated Vegetation Index (NDVI) analyses. We found out that there was notable (38.5%) increase in built up areas, with a corresponding increase in LST. The average temperature (19.6°C) in Greater London increased by 41.3% between 2013-2022. More so, the study found a 16.1% decrease in average temperature between the study time (2000-2022) and a 19.3% increase in average temperature between 2013-2022. Thus, indicating high rate of increase in recent times. Analysis of the NDVI for London Boroughs between the periods (2000,2013 and 2022) revealed significant changes in land use pattern and vegetation cover. There was a moderate to strong positive correlation between LST and NDVI, with R squared values of 0.476 (year 2000), 0.531 (Year 2013) and 0.621 (Year 2022). This result suggests that 73%-79% variation in LST as explained by NDVI. Findings from the study suggest an increase in land use patterns and urban expansion in London Boroughs within the last two decades. These changes portend great danger for urban environment, air quality and LST in Greater London. Based on the results from this study, we recommend sustainable land use management plan for Greater London in order to mitigate the impact of urban expansion.

Keywords: Land Surface Temperature (LST), NDVI, Urban Expansion, Vegetation Cover, Climate Change.



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SMART CITIES AND SUSTAINABILITY IN THE MODERN ERA: EVIDENCE FROM SAINT PETERSBURG, RUSSIA

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ABSTRACT

This paper aims to analyze sustainable cities and the impacts of digitalization and green power generation for eco-friendly urban development. The case study focuses on Saint Petersburg, Russia, using econometric analysis to identify influential sustainability factors. Findings confirm power generation and energy efficiency policies as crucial for transforming Saint Petersburg into a smart city. Practical policies recommended include developing green financial markets, promoting sustainable education, and fostering regional cooperation on sustainable cities. Emphasizing green investments and sustainable education will accelerate the city's transition to eco-friendly practices. Collaborative efforts between neighboring regions will facilitate knowledge sharing and resource optimization. Overall, this research underscores the importance of sustainable cities and how integrating digitalization and green power can drive eco-friendly urbanization, with Saint Petersburg serving as a model for others to follow.

Keywords: Smart City, Sustainability, Green Energy, Sustainable Power Generation.



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WESTERNIZATION PERIOD IN ISTANBUL: OTTOMAN DYNASTY TOMBS, ARCHITECTURAL STYLE AND PEARLESCENT CISTERN FENCES

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ABSTRACT

Ottoman Architecture in the Period of Westernization The 18th century is known as the period of opening to the West of the Ottoman Empire. It will be discussed over the Nakşidil Valide Sultan Tomb, which was built in 1818, one of the Ottoman Dynasty Tombs in Istanbul. Nakşidil Valide Sultan, wife of Abdulhamid I and She is II. Mahmud's mother. Nakşidil Valide Sultan Tomb; It is one of the important structures built by Nakşidil Sultan in 1818 within the Nakşidil Valide Sultan Complex, located in the neighborhood of Istanbul Suriçi Fatih Complex Tabhane and Fatih Mosque Cemetery. This tomb, located on the southeast side of the Fatih Cemetery, under the influence of the Westernization Period, is in baroque architectural style. The mother-of-pearl cist railings of the Nakşidil Valide Sultan Tomb, which contains many branches of traditional Turkish handicrafts such as mother-of-pearl inlay, carving and openwork, are among the most distinguished examples of its time. How is the design of the Westernization Period, the Ottoman Dynasty Tombs, the Architectural Style and the Mother-of-Pearl Cistern Fences? constitutes the research question of the study. In this study, it is aimed to determine the current conditions of the Westernization Period, the Ottoman Dynasty Tombs, the Architectural Style and the Mother-of-Pearl Cistern Fences, and to be the initial step for the restoration application with the feasibility study. The method of the study, the Westernization Period, the Ottoman Dynasty Tombs, the Architectural Style and the design of the Mother-of-Pearl Cistern Railings, on-site determinations in the Nakşidil Valide Sultan Tomb, is an original study based on the relevant literature. In conclusion; Nakşidil Valide Sultan Tomb; It is in baroque style. The mother-of-pearl cist railings of the Nakşidil Valide Sultan Tomb, which contains many branches of traditional Turkish handicrafts such as mother-of-pearl inlay, carving and openwork, are among the most distinguished examples of its time. Today, protecting, maintaining and repairing our movable and immovable cultural heritage is important to prevent major restoration works and to evaluate the current situation as undamaged in the future. These works of art need to be passed on to future generations. The mother-of-pearl inlay workmanship found in many dynasty tombs in the Ottoman Period was synthesized by using different motifs together with the architectural style.

Keywords: Architectural Style, Mother of Pearl Inlay, Traditional Turkish Handicrafts, Tomb, Cistern Fence.



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INVESTIGATION OF KONYA KARATAY MADRASAH BUILT IN ANATOLIAN SELJUKS IN THE CONTEXT OF BIOPHILIC DESIGN CRITERIAS

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ABSTRACT

Biophilic design is the field in which designs emulating nature are examined. The functional compatibility of designs inspired by nature is important for designers. Researchers working on biophilia have created biophilic design criteria by dividing the design criteria into three categories and then into fourteen sub-categories (criteria). This study aims to question the existence of spatial emulation and influence from nature in Konya Karatay Madrasah, one of the historical buildings. Konya Karatay Madrasah was chosen as an example because it is one of the important educational buildings that have been preserved from the Anatolian Seljuks to the present day. In the Anatolian Seljuk period, it is seen that the Sufism belief, which is related to the Islamic belief in madrasas, has an important place in education. According to Islamic belief, the inclusion of the infinity and absolute power of nature in the holy books requires questioning its existence in space, so this study was deemed worthy of examination. In this study based on qualitative analysis method, Konya Karatay Madrasah was spatially examined, photographed and the existence of emulation from nature was questioned through fourteen criteria of biophilic design. As a result, the presence of biophilic design criteria was observed in the spatial examination of Konya Karatay Madrasah and it was understood that there was emulation from nature.

Keywords: Biophilia, Biophilic Design, Karatay Madrasah, Emulation of Nature, Historical Space.



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IMPACT OF DIFFERENT ENTRANCES ON MICROBIAL QUALITY AND PATHOGEN DISTRIBUTION IN HOUSES

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ABSTRACT

This study examines the impact of various entrances on the microbial quality and distribution of pathogens within residential houses. The design and usage of entrances can influence the types and levels of microorganisms present indoors. Factors such as the location of entrances, frequency of usage, and surrounding outdoor environment contribute to microbial contamination. Front entrances, being the primary point of entry, often harbor a higher diversity of microorganisms due to increased foot traffic and exposure to external pollutants. Back doors and side entrances may have lower contamination but can act as secondary entry points for microorganisms already present inside. Moreover, indoor activities and ventilation play a role in microbial quality. To maintain a healthier indoor environment, homeowners should adopt various mitigation strategies. Regular cleaning and disinfection of entrance areas, incorporating antibacterial materials, significantly reduce microbial contamination. Proper ventilation facilitates fresh air exchange, minimizing indoor microbial buildup. Monitoring and controlling humidity levels prevent mold growth, especially in basement entrances. Ensuring pet hygiene and grooming practices further mitigate indoor microbial load. Houses located near sources of pollution or agricultural operations face additional challenges, necessitating heightened attention to indoor air quality. Implementing measures such as using high-quality doormats, establishing shoe-free zones, and periodic inspection and maintenance of both interior and exterior spaces are crucial to reducing risks and promoting a healthier living environment. By proactively addressing the impact of household entrances on microbial quality, residents can create a safer and more hygienic home environment for themselves and their families.

Keywords: Microbial Quality, Cleaning and Disinfection, Maintenance, Indoor Hygiene.



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PERCEPTION TO REALITY: A STUDY ON THE PERCEPTIONS OF ARCHITECTS AND CIVIL ENGINEERS BEFORE AND AFTER THEY STEPPED INTO THEIR CAREERS AND PROFESSIONS

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ABSTRACT

This study intends to inform students who are enrolled in STEM courses or those who have not yet decided to pursue STEM about the realities of possible careers or professions in this field. The goal of this study is to dispel any preexisting misconceptions about what professionals, in particular architects and civil engineers, encounter while performing their duties while aiming to determine the perceptions of professionals before they stepped into their current chosen careers; and, identify their experiences when they actually began working in those particular careers. Using semi-structured interviews, the researchers found



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out the perceptions and experiences of 5 Civil Engineers and 5 Architects regarding their professions. The findings revealed that the key informants had varying perceptions of the professions before stepping into their current careers. The study also highlighted the factors that led to participants pursuing Civil Engineering and Architecture, with many citing personal interests and familial influence. The study further indicated that both professions are math-intensive, although the structural design is a focus for Civil Engineers and aesthetic design for Architects. Salary expectations were found to be a common concern among participants, with some receiving salaries larger than expected, while others were disappointed with lower-than-expected salaries. The study also identified gaps in the application of theoretical knowledge to real-world scenarios and discrepancies between the expectations and realities of the professions. Finally, the study demonstrated that perceptions of the Civil Engineering and Architecture professions were subject to change if it was supplemented by further research, education, and experience.

Keywords: Perceptions, Architects, Civil Engineers, Careers, Professions.



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GREEN BUILDING FOR URBAN SUSTAINABLE DEVELOPMENT

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ABSTRACT

Green building is an important component of the urban sustainable development concept, which aims to ensure a balance between economic growth, social justice and environmental protection. The concept of green building has gradually developed with the growing public awareness of environmental protection, which also encompasses a wide range of elements. Green building is a fundamental platform for sustainable development. A solution for the multidimensional and balanced development of green building has been proposed. Since green building is a trend in the construction industry development, it provides an opportunity to mitigate the effects of global warming, achieve energy efficiency and ensure sustainable urban development. Buildings are the largest human-made objects that cause huge carbon emissions. In addition, buildings are the city's largest energy-consuming asset, accounting for 40% of the world's total energy consumption. Thus, reducing carbon emissions during the life cycle and energy consumption of buildings is the key to reduce the impact on the environment, economy and society and achieve the sustainable development goals. To promote the process of green building development, it is extremely important to raise the awareness of stakeholders. The government should launch campaigns aimed at encouraging developers and tenants to adopt green construction, which could increase the buildings value. Green building in the concept of urban sustainable development demonstrates a strategic approach to the formation of the urban environment, which is aimed at achieving harmony between economic development, social justice and environmental protection. It emphasizes the integration of technology, innovation and social aspects to create cities that provide a high standard of life quality while preserving natural resources and the planet for future generations. Green building constantly requires the search for innovations and new technologies to increase the efficiency of construction and reduce its impact on the environment. This may include the development of new materials, methods of energy saving and optimization of construction processes, which is aimed at creating a healthy and comfortable environment for residents; the use of natural lighting, ventilation and green spaces improves air quality and general well-being of people. Green building in the concept of urban sustainable development should return urbanized areas to healthier, more viable and environmentally friendly places. It contributes to the creation of cities that not only meet the needs of the present generation, but also preserve the possibilities of future generations of our planet.

Keywords: Green Building, Sustainable Development, Energy Efficiency, Environmental Safety.



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THROUGH CURRENT USE CASES OF FAMILY HEALTH CENTERS EVALUATION

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ABSTRACT

Health is an integral part of human life. It is possible for a person to continue his/her vital existence and to maintain his/her life, if his/her physical and mental health can be maintained together. This is achieved by the availability of health services and the efficient meeting of diagnosis and treatment needs. In the provision of health services to the society and the individual, besides medical and technological support, it is necessary to provide care providers and the need for a qualified physical space where all these needs are met. There are family health centers in the first link of the public health service chain in Türkiye. Family health centers provide preventive and primary health care services. The patient/healthy people and their relatives in need of health services, as well as the health personnel serving here, constitute the user group of family health centers. It is necessary to plan qualified physical environment and spatial facilities that meet the needs of all these users. Within the scope of the study, institutions providing primary health care under the name of family practice in the world and family health centers in Türkiye were evaluated with current usage examples. An analysis has been provided, taking into account the spatial, functional, psychological and physical needs of users in primary health care delivery. A spatial evaluation was provided through the findings obtained within the framework of the literature-based design research. As a result of the examinations, the current design problems of family health centers with small-scale public health structures were discussed. In this framework, it is aimed to eliminate the existing design problems of family health centers and to draw attention to the need for a qualified interior design in these institutions where everyone can access health services equally.

Keywords: Family Healthcare Centers, Family Practise, Interior Analysis.



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ANALYZING THE EFFECTS OF URBAN SUSTAINABILITY ASSESSMENT TOOLS ON CITY BRANDING: THE CASE OF LEED, BREEAM, YeS-TR

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ABSTRACT

Today, it is important to produce more ecological and innovative solutions for cities to integrate into the global system, to take part in the competition among cities and to ensure sustainability. Considering the multifaceted and complex structure of cities, achieving innovative and sustainable urbanization is a challenging process. Urban sustainability assessment tools such as LEED, BREEAM, YeS-TR have been developed in line with the necessity to consider cities as a singular and holistic system. Urban sustainability assessment tools are directly linked to sustainable development goals and address cities from ecological, economic and social perspectives. When the elements that constitute city branding such as ecological and aesthetic values, architectural structure, transportation, culture, tourism, trade and industry opportunities, local administration, education and religion are considered, it is seen that urban sustainability assessment tools have a direct positive impact on the city branding process. Within the scope of this study, the effects of LEED, BREEAM, YeS-TR urban sustainability assessment tools, which have a common purpose but have different criteria and procedures when examined in detail, on the city branding process are examined. As a result of the study, it was observed that the YeS-TR system, which is Türkiye's domestic certificate, produced stronger results.

Keywords: City Branding, Urban Sustainability Assessment Tools, LEED, BREEAM, YeS-TR.



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BACKGROUND OF THE PROCESSES OF COMBATING CLIMATE CHANGE OF LOCAL GOVERNMENTS IN THE SCOPE OF URBAN PLANNING

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ABSTRACT

The areas where the greenhouse gas increase, which causes climate change, is observed the most, are the cities where human activities are concentrated. Cities are both the factors that cause climate change and the areas most affected by climate change. Therefore, the steps to be taken in cities are important for the fight against climate change to be successful. The prominent actor in cities is local governments. local governments; play a key role in the fight against climate change with their jurisdictions, working boundaries, and opportunities to intervene in areas within the city that trigger climate change and are affected by the negative effects it creates. However, there are some obstacles in front of local governments at this point. The aim of this study; is to identify all aspects of the obstacles that local governments face in the process of combating climate change. In this context, semi-structured interviews were conducted with İzmir central district municipalities (11) and İzmir Metropolitan Municipality. The main finding obtained in the interviews is that the obstacles faced by local governments in Türkiye diverge from the obstacles in the world at important points. While the obstacles created by legal processes are less common in world literature, the most important obstacle encountered in Türkiye is legal obstacles and specialization. Weaknesses in climate policy and action plan preparation processes, and various legal obstacles such as authority limitations and ownership are the important obstacles faced by local governments.

Keywords: Climate Change, Urban Planning, Local Governments, Climate Action Plan.



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THE IMPACT OF THE PANDEMIC ON INTERIOR DESIGN: LESSONS LEARNED

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ABSTRACT

The COVID-19 epidemic has had a profound influence on many parts of life, including interior design. The purpose of this research is to examine the influence of the pandemic on interior design and to identify the lessons learnt. Several research on the impacts of the pandemic on interior design have been done, including changes in teaching methods, the impact on students' writing outcomes, and the altering office interior design. The research also looks at how minimalism in design has influenced people's expectations during and after the epidemic. The study investigates the consequences of the pandemic on student learning, social interaction, and health, and proposes a hybrid working arrangement for post-pandemic interior-architecture consultants. The study's findings can assist interior designers and architects in adapting to the new normal and creating secure, useful, and aesthetically beautiful places for individuals and communities. The study's goal is to investigate the effects of COVID-19 on the interior design business and identify the lessons learnt. The study's goal is to give insight into how interior design trends and practices have changed as a result of the pandemic, as well as the problems and possibilities that interior designers have encountered throughout this period. The study draws on a variety of sources, including research papers, case studies, and conference proceedings, to present a thorough overview of the pandemic's influence on interior design. Interior designers, researchers, and experts in related sectors may find the study interesting. A comprehensive literature review was used to locate relevant publications published in academic journals for the investigation. The study examined publications on several elements of interior design, such as the pandemic's influence on teaching methods, student performance, office design, and home interior design. The findings of each article were studied in order to determine the significant trends and developments in the area of interior design as a result of the epidemic. The research emphasizes the significance of adapting interior design to society's shifting requirements throughout the epidemic and suggests incorporating new technology and techniques into the design process. The study draws on various papers on interior design and allied sectors to show how the pandemic has influenced interior design trends, instructional approaches, and workplace design. The study also looks at how interior design might help to create healthy living environments in times of crises. In the post-pandemic period, the study emphasizes the relevance of human-centered design and the necessity for hybrid working systems. The study's results emphasize the significance of adjusting to changing conditions, as well as the need for designers to reconsider their approaches to interior design in light of the epidemic. Furthermore, the study underlines the need of planning living and working environments with human well-being and health in mind.

Keywords: Pandemic, Adaptation, Interior Architecture, Education, Design.



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ART AS INSPIRATION IN INTERIOR SPACE

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ABSTRACT

Space, which is a multi-layered and dynamic concept, has been attempted to be understood by human beings as a physical reality that defines the space we live in, such as boundary, place or space. For the early humans, while meeting the needs of shelter as a space, they also expressed themselves by describing their lives with the pictures they drew on the cave surfaces. These descriptions have been accepted as the most primitive artistic expressions. Developing and changing opportunities in time have found various representation areas such as philosophy, literature and architecture at the intersection of art and space. The aim of this study is to examine the architectural production environment and interdisciplinary interactions we are in through the mutual relationship it establishes with art. The main question of the research focuses on how art can enable an alternative approach to the contemporary conception of space as inspiration. It is aimed to understand the dynamics of the interaction environment based on the inspiration of art for different disciplines, to reveal the ties, opportunities and potentials for the current situation and the future in the light of examples. Regardless of the definition of space adopted, producing and sharing art-inspired expressions will contribute to the establishment of an alternative framework in the interior. For this reason, the concept of space necessitates the existence of this discussion in the context of its relationship with art.

Keywords: Art, Space, Inspiration.



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SEARCHING BOUNDARIES OF INTERIOR ARCHITECTURE EDUCATION IN THE CONTEXT OF KNOWLEDGE AREA AND PROFESSIONAL FIELD

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ABSTRACT

In Türkiye, the number of interior architecture / interior architecture and environmental design programs has been growing quickly since 2000. In spite of this growth, it is apparent that there are not enough educators pursuing postgraduate degrees in interior architecture. The administration of educational quality is the primary issue facing active interior architecture programs. Therefore, when evaluating the effectiveness of educational institutions, the boundaries of interior architecture should be clearly defined together with the scientific and professional domains to which it is associated. A uniform, homogenous, and strict framework governs the systems developed to assess the quality of education in interior architecture programs located in various geographic locations with various historical identities and contexts. The framework of education programs in interior architecture that enable circumstances for human development, lifelong learning, specialization from a multidisciplinary perspective, and approach global concerns with local values is still up for debate. For this reason, this study proposes ways to be heterogeneous and polyphonic through a holistic and systematic model in order to develop multidisciplinary education that supports the possibilities of technological development and socio-cultural change by focusing on the knowledge area, theory and ethics.

Keywords: Interior Architecture, Education, Field, Knowledge Area, Theory, Ethic, Holistic Model.



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RE-FUNCTIONING WITHIN THE SCOPE OF CONSERVATION AWARENESS IN INTERIOR ARCHITECTURE EDUCATION: THE CASE OF PAŞALIMANI FLOUR FACTORY

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ABSTRACT

“Re-functioning” is one of the most important work areas for architects, interior architects, and designers to have the awareness of preserving existing cultural structures. It is possible to bring historical buildings with cultural importance that have lost their function to life in the city, by re-functioning. Many historical buildings that lost their function in the 21st century serve different functions by carrying out restoration works. Like architects, restorers, and art historians, interior architects must be conscious and highly aware designers of the protection of cultural assets. One of the most important stages for interior architecture students to reach this awareness is undergraduate education. In this direction, the subject of Biruni University Interior Architecture and Environmental Design, 2021-2022 Spring Term, Interior Architecture Project IV course was determined as "Temporary Accommodation Design" to preserve cultural assets and transfer them to future generations, and Üsküdar Paşalimanı Flour Factory (Istanbul/Türkiye) was given as the project area. Within the scope of the study, students were asked to evaluate Paşalimanı Flour Factory, which is a historical building but is now idle in the city, as a temporary accommodation function with the awareness of protection. When the final products that appeal to different user profiles are evaluated, it has been observed that the students have developed contemporary approaches that preserve the historical texture, as well as the common orientations, and have adopted the importance of the concept of conservation to a large extent.

Keywords: Interior Design, Conservation, Functional Transformation, Temporary Accommodation.



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PRODUCTION OF POST-DISASTER INTERIOR SCENARIOS

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ABSTRACT

Disasters, which have been a natural occurrence throughout history, have created many negative effects on individuals and their settlements. The century we live in causes communities to experience many crisis situations due to reasons such as natural disasters and epidemics. The chaos environment created by extraordinary and uncertain situations arising from different reasons is an important problem faced by the design discipline at urban and architectural scale. The aim of the designers in the mentioned environment is to provide resources to meet the post-disaster needs required by disaster situations and to enable the creation of post-disaster living space scenarios. This situation necessitates temporary and permanent interior scenarios that explain the post-disaster life, orientations and needs of individuals. The aim of the research is to read the existing spatial potentials and to present design suggestions for the disaster scenarios that we are likely to encounter in the current period. Within the scope of the research, new and temporary interior scenarios created by disaster situations are examined and potential interior solutions are questioned. As a result of the research, design proposals that meet the temporary order needs for the changing life flow of individuals who are disrupted in their daily life in case of disaster are presented. This study aims to understand the effective forces in the post-disaster periods to improve the reconstruction and planning processes with the knowledge gained from the research carried out and also to provide data to the academic field with policy-making authorities.

Keywords: Post-disaster, Interior Scenarios, Place Making.



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SUSTAINABILITY OF SEATING ELEMENTS WITHIN THE SCOPE OF URBAN FURNITURES, RIZE EXAMPLE

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ABSTRACT

Sustainability has become effective in urban planning and development processes, as in every field. Although the concept of sustainability finds its place in the upper scale in urban studies, it is a matter of debate how much it takes place in subscales such as the urban furniture scale. In order for cities to become sustainable, it is necessary to take into account the smallest component of the city and give the necessary importance in terms of sustainability. In addition to the resources spent on urban furnitures, the suitability of the urban furnitures for the health of the citizens, as well as the durability and longevity of the furniture used especially for humid coastal areas, to climate and other external factors are open to discussion. In this sense, it is necessary to examine the urban furnitures in different climates and to become sustainable and compatible with the climate and other external factors. In this context, the province of Rize, which has factors that shorten the life of materials due to its climatic structure and humidity values, stands out as a different sampling area in the research of the sustainability of urban furnitures. When the urban furnitures is examined, sitting elements come first among the urban furnitures that is constantly used by the user. In this sense, ensuring the sustainability of the seating elements will be a good start in terms of the sustainability of the furnishings in the city. In this study, the sustainability of the living elements, which are located in the coastal landscape arrangement of the city of Rize and are used quite frequently in the city, were analyzed through the MET (Material, Energy and Toxicology) matrix in their life cycles. The findings obtained from the analyzes were discussed in the direction of eco-design criteria, and suggestions were developed on how the settlement elements could be for humid coastal areas. As a result, the suggestions developed to ensure the sustainability of urban furnitures in terms of humid and rainy regions will contribute to the cities and the future of humanity.

Keywords: Rize, Urban Furnishings, Sustainability, Landscape, Eco Design.



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ALTITUDE OF HOUSEHOLDS TOWARDS WASTE MANAGEMENT PRACTICES IN URBAN SLUMS OF IBADAN METROPOLIS, OYO STATE, NIGERIA

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ABSTRACT

The study examined the altitude of households towards waste management practices in urban slums of Ibadan metropolis. Oyo State, Nigeria. A multistage sampling technique was used to select one hundred and five (105) respondents from three (3) Local Government Areas in Ibadan metropolis. Data were collected with the aid of interview schedule and analyzed with both descriptive and inferential analysis. The results showed that majority of the respondents (61.0%) were female, 76.2% were married with 42.9% of the respondents age ranging between 31-40 years and 89.8% of the dwellers monthly income between #10000(\$11)-#40000(\$44). 64.3% of the respondents had households size ranging between 5-8 members and 70% of the respondents without access to government waste collection services. A significant number of respondents (94.3%) generated a high level of sewage waste while 89.5% of the respondents generated nylon waste and 83.8% reported that paper wastes were always generated and dumping indiscriminately in the study area. Also, it was revealed that the altitude of the respondents towards toward waste management were unfavorable. Gender ($X^2=0.273$), Marital status ($X^2=0.084$), membership of association ($X^2=3.591$) were found to have no significant relationship while positive relationships existed between education ($X^2= 9.466$) as well as access to waste collection services ($X^2= 8.033$) and altitude of the respondent towards waste in the study area. Also, there is a significant relationship between waste management strategies employed by the respondents and their altitude towards waste management ($r=0.360$, $p=0.000$). It was therefore concluded that altitude of the households were unfavorable to the waste management in the study area. The study therefore recommends the need for government to provide adequate funds for proper execution of environmental programs as this would secure new modern waste management technology in the study area.

Keywords: Altitude, Households, Urban, Slums, Waste Management.



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NOTE ON TRANSLATED SUM ON PRIMITIVE SEQUENCES

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ABSTRACT

In this note, we construct a new set S of primitive sets such that for any real number $x \geq 60$ we get:

$$\sum_{a \in A} \frac{1}{a(\log a + x)} \geq \sum_{p \in P} \frac{1}{p(\log p + x)},$$

Where S is a set of primitive sequences of the forme

$$A_d^k = \{p_1^{\alpha_1} p_2^{\alpha_2} \cdots p_k^{\alpha_k} \mid \alpha_1, \dots, \alpha_k, d \in N, \alpha_1 + \alpha_2 \cdots + \alpha_k = d, d \geq 1\},$$

For $d = 2$.

where P denotes the set of prime numbers.

Keywords: Primitive Sequences, Erdős's Conjecture, Prime Numbers, Integer sequence.



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THE DIFFERENT TYPES OF MESOPOROUS MATERIALS

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ABSTRACT

Porous materials have been intensively studied with regard to technical applications as catalysts, catalyst supports, and adsorbents. According to the IUPAC definition, porous materials are divided into three categories: microporous (pore size 50 nm) materials. The advantages of mesoporous materials are summarized as follows: (a) Mesoporous materials have highly ordered and controllable size which enable the size-selective adsorption of small molecules but the size-exclusion of larger molecules, providing molecular weight cutoff in sample enrichment. (b) Mesoporous materials have high surface areas and large pore volumes which provide sufficient capacity for the adsorption of reactants. (c) The framework of mesoporous materials can be various oxides, including silica, alumina, or transition metal oxides. The transition metal oxides are particularly important among non-silica mesoporous materials because they possess d-shell electrons confined to nanosized walls, redox active internal surfaces, and connected pore network. Additionally, the mesoporous structure of SBA-15 allows for easy accessibility of reactants to the active sites on the silver nanoparticles, further enhancing the catalytic activity. The tunable pore size also allows for the possibility of size-selective catalysis, where only molecules of a certain size can access the active sites.

Keywords: Mesoporous Materials, D-Shell Electrons, SBA15.



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THE ASSESSMENT OF FIAT COMPETITIVENESS IN THE EUROPEAN ELECTRIC VEHICLE MARKET (YEAR 2022)

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ABSTRACT

The aim of this study is to check the competitiveness of FIAT 500 in the electric vehicle of some European market for the year of 2022. The electric vehicle is found to tackle the over consumption of unrenovable energies such as fuel, also, the second target is reducing CO2 emissions as the principles of sustainable development demand. As result, the model of FIAT 500 is ranked in the 3rd position of the top 10 models with 52.949 sales, followed by Dacia Spring, Volkswagen ID, Hyundai Kona electric, Peugeot 208 EV, Kia Niro EV and Renault ZOE. It should be noted that TESLA is the leader in this particular market with 108.294 sales.

Keywords: Sustainable Enterprise, Social Corporate Responsibility, Sustainable Development, Electric Vehicle, FIAT, Europe.



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DIATOMITE ITS CHARACTERIZATION, THERMAL MODIFICATION, AND APPLICATION: A REVIEW

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ABSTRACT

Diatomite or diatomaceous earth otherwise known as infusorial earth, kieselguhr, or mountain flour. Diatomite rock is a loose, earthy or loosely cemented porous and lightweight rock of sedimentary origin, is a very important natural material used in many industries. It has distinctive physical and chemical properties. Diatomite A fine-grained, weakly cemented, porous and lightweight sedimentary siliceous rock. Depending on the amount of impurities present, its colour varies from white to yellowish, dark and brownish grey. Diatomite is a siliceous sedimentary rock consisting mainly of the fossilised skeletal remains of diatoms, unicellular aquatic plants related to algae, during the Tertiary and Quaternary periods. Diatoms are well-known for their versatility as indicators of past environments and climates. They are characterised by their low bulk density, their low thermal conductivity, and their inert chemical reactivity with the majority of liquids and gases, and their low solubility in water. Water adsorbed on the surface of diatomaceous earth and hydrated water bound to divalent cations are released at temperatures between 110 and 180°C, and insignificant amounts of water are released at 800°C. These properties make diatomaceous earth a very attractive natural material. It is characterised by high permeability, high porosity and a large surface area. Diatomaceous earths have a wide range of uses and applications such as moisture control materials, filtration materials, as raw materials for cement production, as starting materials for the production of sustained release drug vectors, sorption, desorption, purification and waste water treatment. pozzolanic material, pesticide carrier and also as a material for improving the physical and chemical properties of certain soils, immobilisation of heavy metals by diatomite etc. The review deals with diatomaceous earth on a global scale, its characterisation, its modifications and composites, as well as its industrial applications.

Keywords: Diatomaceous Earth, Pozzolanic Material, Fine-Grained, Cemented Porous, Infusorial Earth.



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THE PRODUCTION OF ELECTRICAL ENERGY BY THE DIFFERENT TYPES OF POLLUTING AND RENEWABLE ENERGY

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ABSTRACT

The objective of this study was to explore a new approach combining o study the different methods of producing electrical energy. Photovoltaic system components have also been introduced with characteristics and types of each ingredient. We will deal with the influence of temperature and the effect of irradiation on the energy produced by photovoltaic cells. The most common fossil fuels are coal, oil and gas. They are mainly composed of carbon. To use the energy they contain, man must extract them from the ground and burn them. They can be used for heating, lighting or moving around. However, each has its specificities that make it more suitable for one use or another. Renewable energies have a certain appeal when you consider that they can provide cheap and ecological electricity, to isolated residential areas, localities without means of connection to the electricity grid, but they can take advantage of techniques that have been developed to exploit natural resources. Electricity and heat. With three billion people without electricity, renewable energies can certainly play an important role and contribute to the economic development of poor regions.

Keywords: Renewable Energies - Photovoltaic Solar- Production of Electrical, Fossil Fuels.



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DEVELOPMENT OF STANDARD ELECTRICAL APPARATUS FOR DETERMINATION OF ACCELERATION DUE TO GRAVITY AMONGST UNDERGRADUATES PHYSICS STUDENTS IN NIGER STATE, NIGERIA

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ABSTRACT

This study aimed at developing Standard Electrical Apparatus for Determination of Acceleration due to Gravity amongst Undergraduates Physics Students in Niger State, Nigeria. Three research objective and three research question were raised. The study employed instrumentation research design. The population of the study consisted of one thousand three hundred and thirty five (1,335) undergraduate Physics students from which a total of thirty (30) undergraduate Physics students were drawn and used for testing and evaluating the accuracy of the instrument at five different locations using simple random sampling techniques. A validated physics practical instruction manual was used to test the apparatus. Collected data was analyzed using Mean (Σ) and standard deviation (SD) to answer the research questions. The findings of the study revealed the mean experimental values of acceleration due to the gravity of Standard Electrical Apparatus for Determination of Acceleration due to Gravity and simple pendulum were 9.83 m/s^2 and 10.47 m/s^2 respectively. On the basis of these findings, the study concluded that Standard Electrical Apparatus for Determination of Acceleration due to Gravity gives more accurate value of (g) close to the constant value than the simple pendulum. The study therefore, recommended among others that, Standard Electrical Apparatus for Determination of Acceleration due to Gravity should be adopted in the conduct of Physics practical at all level of education in Niger State, Nigeria.

Keywords: Gravitiy, Physic, Student.



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ELECTROMAGNETIC ABSORBER

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ABSTRACT

Based on the shock absorber size and power and power density limitations in motorcycle application, a linear permanent magnet machine for a regenerative suspension system that recovers the kinetic energy originating from shock absorber vibration is investigated. To achieve the target power of 120 W, several design parameters were investigated. The eight-slot eight-pole combination was used due to its high power density. A hybrid permanent magnet structure was implemented which was a combination of a classical Halbach array and iron spacers. In addition, the dimensions of the permanent magnet, and stator inner radius were parametrically studied to enhance the airgap flux density and coil volume, which are the main factors affecting performance. The detailed design generated 124 W of average power under the rated condition, assuming a vibration speed of 0.157 m/s. Despite the satisfaction of the output power and power density, the large magnetic force caused by the interaction between the iron core and permanent magnet is the main drawback of this design, which has a negative impact on driving safety and comfort. To commercialize the suggested device, additional studies will focus on size, electromagnetic reduction, as well as road test performance.

Keywords: Kinetic Energy, Shock Absorber, Power.



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A REVIEW OF ECONOMIC IMPORTANCE AND VIABILITY OF GOLD: A CASE STUDY OF ILESHA SCHIST BELT, SOUTHWESTERN NIGERIA

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ABSTRACT

Gold, one of the natural resources Nigeria is endowed with, is a precious metal with a high market value and great economic significance, with known occurrences in alluvial and eluvial placers and as primary veins in several regions of the Schist Belts in the northwest and southwest of Nigeria. Full development of the resource for mining and production around the Iperindo axis of the Ilesha Shale Belt in southwestern Nigeria has been constrained by a lack of relevant geoscience data. This work elaborates on the economic significance of gold in the area base on the examined works on geosciences research in the study region. Six Frequency Domain Electromagnetic (FDEM) and five Electrical Resistivity Tomography (ERT) profiles were occupied using Geonics EM34-3 conductivity meter and SuperSting R8/IP/SP resistivity meter, respectively, to evaluate the gold mineralization potential of the study area. Purposively collected nine soil samples and eleven stream sediments samples were analyzed. The samples were analyzed at the Bureau Veritas Minerals Laboratories, Vancouver, Canada. The acquired apparent resistivity data from the ERT profiles were inverted, using RES2DINV inversion software. The inverted ground resistivity and apparent conductivity data were sorted and gridded to generate 2D conductivity/resistivity sections, maps and 3D subsurface models, employed to characterize the subsurface. The generated geochemical data were processed using MS Excel and SPSS packages to generate different plots. The analysis indicated relatively shallow low resistivity / high conductivity zones that are primarily limited to the eastern and western edges of the study area as viable areas with potential for gold or other base metals mineralization occurring in pegmatitic veins located within identified zones. It is impossible to overstate the significance and importance of the subsurface data generated in this study, particularly for the commercial exploitation of the Ilesha Schist belt's gold mineralization potential. Instead of the growing artisanal mining operations in the area, this might generate royalty tax for the government and lead to job creation and economic growth for the local community as well as the nation.

Keywords: Gold Mineralization, Low Resistivity / High Conductivity Zones, Pegmatitic Veins, Threshold, Iperindo.



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INDUSTRIAL RISK ANALYSIS AND CONTROL CASE STUDY «TERMINAL ARRIVE EL KALA GK03 SONATRACH ALGERIA

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ABSTRACT

With the worldwide increase in major accidents linked to complex production systems, industrialists are forced to design so-called safe installations. This awareness has led to more pronounced regulation and standardization. This is the case, for example, of the methodology for analysing the risks of machines and their evaluation with a view to their reduction, recommended by ISO 14121 and ISO 12100. Indeed, these standards introduce a methodology that analyzes process-risk on an ongoing and iterative basis until initial objectives are achieved. It is in this context that our work of focusing, as part of this risk analysis methodology, is integrated processes, on hazardous phenomena during the execution of tasks that require the integration of the prioritization of performance indicators. For this, we have completed this process with TPF decomposition in order to capitalize on these dangerous phenomena in order to optimize the security requirements and obtain the level of safety.

Keywords: Process Tasks Function, Dangerous Names, Acceptability Criteria, LOPA, SIL, HAZOP, SIS.



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INVESTIGATION OF HIGH VOLTAGE CAP AND PIN INSULATORS PERFORMANCE UNDER DIFFERENT POLLUTION CONDITIONS

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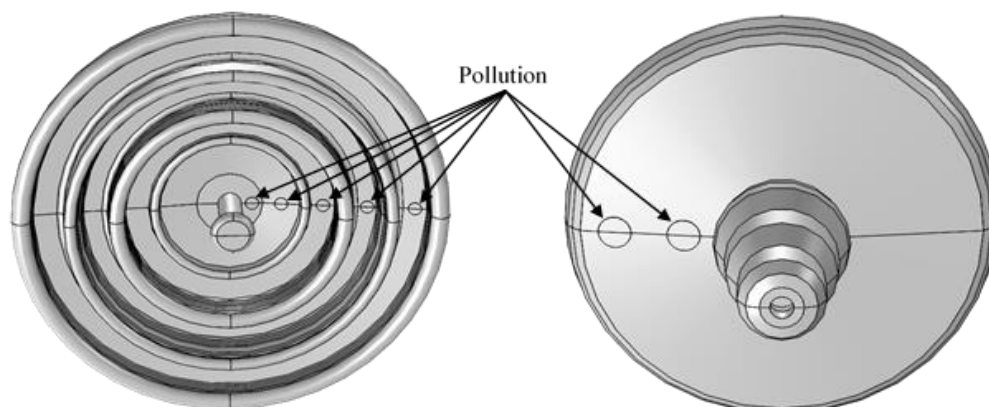
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ABSTRACT

In this work, a study of the electric potential and electric field distribution is presented. The knowledge of these distributions play an important role in the design of the insulators and how to counter various problems that occur during the service of the insulator. For this study COMSOL Multiphysics 5.6 software is used which is a software based on the finite element method to study an insulator chain in a clean state and under different conditions of pollution. The electrostatic physics was chosen under a stationary study so the 3D model is simulated is made. The results showed that there are some similarities between the behavior of the electric potential and the electric field and some differences under the different conditions.

Keywords: Cap and Pin Insulator, Electric Field, Electric Potential, Numerical Simulation.





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CONTROL ALGORITHMS OF SHUNT ACTIVE POWER FILTER FOR HARMONICS MITIGATION IN A FOUR-WIRE DISTRIBUTION NETWORK

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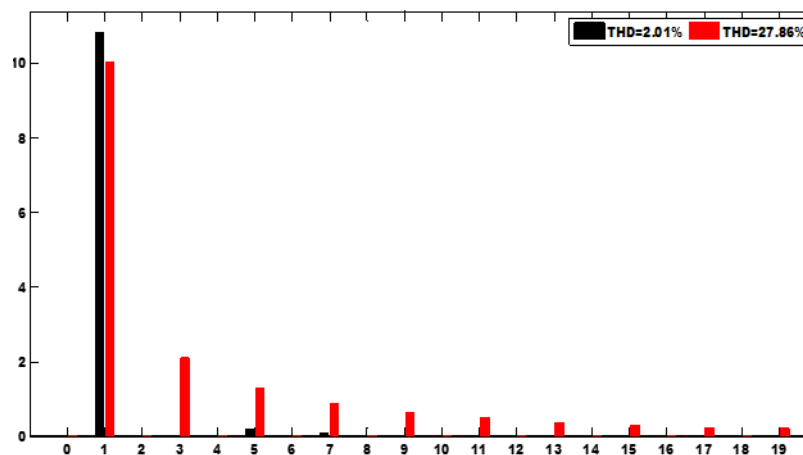
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ABSTRACT

One of the most important power quality problems, current harmonics has generated a lot of study attention. The greatest way to reduce harmonic contamination is to use a shunt active power filter (SAPF), however, its efficiency is entirely reliant on how quickly and precisely its control algorithms can work. This study investigates the functioning of a four-wire shunt active power filter (SAPF) under unbalanced load situations using a simulation of a three-phase four-wire shunt active power filter (SAPF) decreased current measurement control technique caused by nonlinear loads. The suggested method for correcting the load's reactive power and harmonic currents is effective, according to simulation results produced by Matlab/Simulink.

Keywords: Active Power Filter, Three-phase Four Wire Systems, Harmonic Compensation



Graphical ABSTRACT



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NEW APPROACH FOR PREDICTION THE AC BREAKDOWN VOLTAGE USING DESIGN OF EXPERIMENTS

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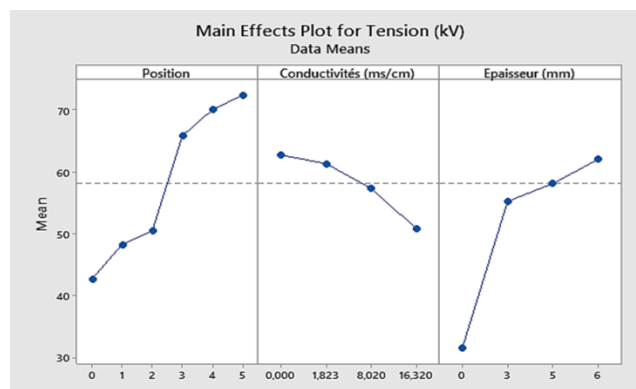
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ABSTRACT

Many studies have been done recently, notably in the geometry of the point plane, in the area of discharge and breakdown processes. In this study, a numerical model based on the experimental design technique (DOE) is provided to forecast the breakdown voltage of a point-barrier-plane structure contaminated by Minitab. A strong connection is found between the findings produced and measurement values found in the literature, confirming the efficacy of the suggested procedure.

Keywords: DOE, Point-Barrier-Plane, Pollution, Breakdown Voltage, Minitab.



Graphical ABSTRACT



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STUDY OF ELECTRIC FIELD DISTRIBUTION ON INSULATORS USING FINITE ELEMENT METHOD

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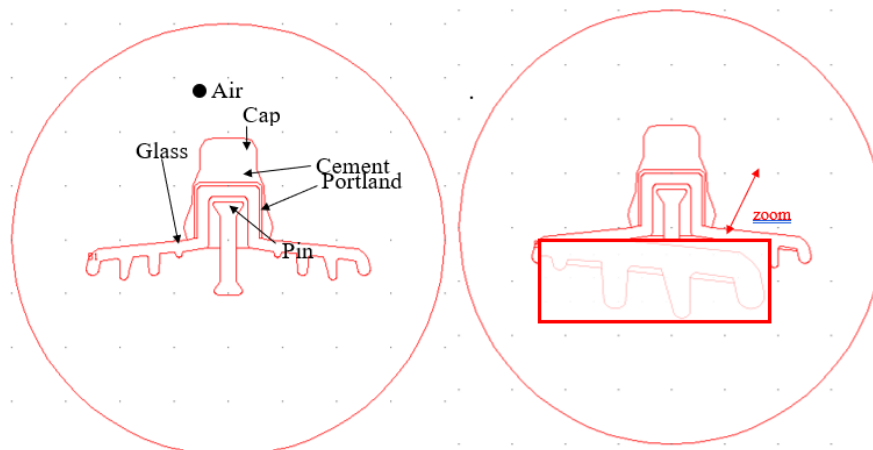
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ABSTRACT

Electrostatic forces and persistent partial arcs under HVAC stress are the main contributors to insulator pollution. Understanding this behavior is essential because contaminated insulator flashover can cause extensive, protracted power outages. Pollution flashover is a crucial factor to take into account while building transmission lines and conversion facilities, especially those used in AC systems. This work uses a two-dimensional (2D) numerical model based on the finite element method to examine how the potential and electric field are distributed throughout the model's leaking distance. The COMSOL Multiphysics simulation results obtained show that the suggested approach is successful and yields positive outcomes

Keywords: Insulators, Mesh, Electric Field, Electrical Potential, Comsol.



Graphical ABSTRACT



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NUMERICAL SIMULATION OF THE ELECTRIC FIELD AND THE POTENTIAL DISTRIBUTIONS IN HETEROGENEOUS CAVITIES IN HIGH VOLTAGE CABLES

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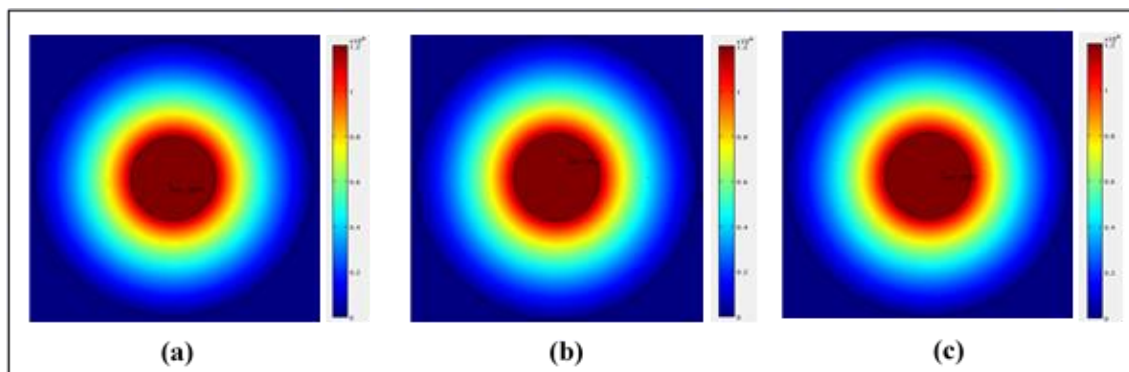
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ABSTRACT

Heterogeneous cavities, such as bowtie water trees, vented cavities, and air void cavities, are easily damaging to XLPE power cables. This paper studies the electrical constraints within an XLPE-insulated cable containing micro-cavities. Due to the possibility of partial discharge (PD), it is crucial to be aware of the existence of heterogeneous cavities in insulating materials before using them as cable insulation. This study examines the impact of having such diverse voids in the insulation of high-voltage cables. Additionally, using the COMSOL tool, the impact of altering the cavity's position and size on the PD behavior under various operating circumstances was examined. The obtained results are in good agreement.

Keywords: Heterogeneous Cavities, Electric Field and Potential, Cables.



Graphical ABSTRACT



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ROLE OF BRAND EXPERIENCE IN BUILDING CONSUMER LOYALTY – A CONCEPTUAL STUDY

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ABSTRACT

Product and service marketing has always centered on objective characteristics like price, availability, and quality. Consumers, however, do not merely acquire goods and services, as evidenced by several research. Indeed, marketing scholars have been arguing for a shift in emphasis toward relationship management and value generation for a while now. Researchers and practitioners in the field of marketing have come to realize in recent years that the quality of the customer's experience is the primary variable that needs to be managed in the present. This study looked into the influence that several aspects of a brand's experience have in determining a customer's loyalty. The study will contribute to the body of knowledge by shedding light on the expanding role of brand experience aspects. Academics and business leaders alike could learn from the results of this study conducted.

Keywords: Brand Experience, Consumer Loyalty, Consumer Behaviour.



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FACTORS INFLUENCING CONSUMERS' PREFERENCES FOR SUSTAINABLE TRANSPORTATION – A CONCEPTUAL STUDY

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ABSTRACT

In recent years, globalization-related issues, concerns about sustainability, and the need for greater competitiveness have necessitated the adoption of new transport network development strategies and models. Sustainable consumer research is receiving a growing amount of attention; yet, it is still underrepresented, and additional research is required. On the basis of these considerations, the authors of this publication conduct an analysis of consumer preferences and consumer behavior in relation to electric vehicles (EVs) as a sustainable innovation. With the introduction of cutting-edge vehicle technology such as autonomous driving systems and alternative fuel sources, the transportation sector is undergoing a dramatic transformation at an unprecedented rate. Electric vehicles have been proven to have the potential to contribute to the environmental viability of transportation systems by lowering the overall carbon footprint of individual vehicles. This article provides a comprehensive analysis of consumer preference for electric and autonomous vehicles in an effort to obtain a better understanding of consumer attitudes and behaviors regarding the acceptance and deployment of smart vehicle technology. The purpose of this study is to gain an understanding of the motivational factors that contribute to customers' preferences for electric vehicles (EVs).

Keywords: Electric Vehicles, Consumer Behavior, Environmental Concern, Sustainable Transportation.



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MUTUAL WETTING CAPABILITIES OF OIL-WATER: POLYMER: ROCK IN SOME OIL FIELDS IN ALBANIA

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ABSTRACT

As everywhere, the reservoirs are water-wet and sometimes alternate with oil-wet areas. In the case of examining the only well in Albania where polymer injection is carried out, that of Patos Marinza we see the same rule, where, as a result, with the use of wells, the saturation of the night in the reservoir decreases, and as a result, the amount of oil will be called extractable oil. As a result, the wet oil parts of the layer will be reduced and what observed is the phenomenon of water wetting of the rock. Regarding the injection of the polymer it is observed that it is greatly affected by the wettability of the core. Wettability is defined as the tendency of a liquid to spread or adhere to the surface of a solid surface in the presence of another immiscible fluid. Reservoir wettability is an important and elusive petro-physical parameter in all types of core analysis, which affects saturation and improved oil recovery processes. In the engineering concept for the exploitation of the reservoir of oil, there is the opinion that in water-wet cores, injection is done more efficiently than oil-wet cores, that is, more in the first stages of injection from water-wet rocks compared to oil-wet ones. The polymer flooding process involves the injection of a polymer "plug" followed by continuous and long-term water flooding to drive the polymer plug and the oil "bank" ahead of it toward the production wells. Based on the principle of mobility ratio as we showed above, water-soluble polymer reduces water mobility by two mechanisms: a- by increasing the viscosity of the aqueous phase, b-by reducing the relative permeability of water in the rock pores, by adsorption and retention of the polymer at the mouths of the rock pores and thus creating a more efficient and uniform front to displace the contained oil from the reservoir. The mineralogy of the analyzed samples showed a variable amount of dolomite in their composition, which consists of dolomite grains and a small amount of dolomicrite in a very fine form. The quality of the sand reservoir in Driza seems to be very good. The porous sand and pore system is practically very clean. This can create a problem with narrow pore throats. Injection of the polymer is also associated with the concern of its stability against several factors. The factors that affect the stability of the polymer, and therefore its effectiveness, are: injection pressure; temperature; stirring speed; salinity of water etc.

Keywords: Polymer Injection, Oil Reservoirs, Petro-physical Parameters, Wettability.



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CHALLENGES FACING THE ADOPTION OF NEW PUBLIC MANAGEMENT STRATEGIES IN THE NIGERIAN LOCAL GOVERNMENTS

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ABSTRACT

In Nigeria, several government reforms aimed at adopting NPM strategies at all levels has not yielded expected result, especially at the local government levels that are closer to the citizens for efficiency in social service delivery. This research aimed at examining the challenges facing the adoption of NPM strategies in the Nigerian Local Governments. The importance of local government as a driver for formulating and implementing public policy necessary for efficient and effective service delivery in Nigeria substantiate the necessity for NPM strategies that has proved effective in the developed countries. This study adopted survey research design based on positivism philosophy and deductive approach for data collection and analysis. The population of the study comprise of 8,250 staff of local governments in Lagos State, Nigeria. The choice of this state is due to unified structure of local government administration in Nigeria. The study adopted Multi-Stage sampling technique to have a sample size of 357 for questionnaire administration. Data collected were analysed using frequency distribution table, percentage and mean value to rank those challenges. The findings of the study revealed that political challenges are more severe than economic, social and bureaucratic challenges facing the adoption of NPM strategies in the Nigerian local government. The study concluded that efficient and effective social service delivery can be achieved at the local government level in Nigeria if those challenges are tackled to the barest minimum.

Keywords: Public Administration, New Public Management, Public Policy, Bureaucracy, Public Service Delivery.



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GEOPOLITICAL IMPORTANCE OF AFGHANISTAN FOR CHINA

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ABSTRACT

Afghanistan has always been at the center of attention of the global and regional actors due to its geopolitical and geoeconomic position. Throughout history, its invasion by the Persians, Greeks, Mongols, Great Britain, and Russians, as well as facing the U.S. intervention in 2001, were all related to its geopolitical importance. A power that dominates Afghanistan will also have the opportunity to control the regions such as Central Asia, the Middle East, and South Asia very easily because Afghanistan is a country that makes it possible for the above-mentioned regions to get connected and carries a "bridge role" for them. Likewise, the increasing importance of Afghanistan in the foreign policy of China, which has developed rapidly in recent years and is nominated as a hegemonic power, is undoubtedly related to its geographical location, rich minerals, and energy resources. In this study, the geopolitical importance of Afghanistan in the foreign policy of rising China will be analyzed descriptively, and while doing that, the geopolitical approaches in International Relations have been utilized. As a result of the study, it has been found that Afghanistan still maintains its geopolitical importance and the significance that China attaches to Afghanistan, its efforts to be an effective actor in Afghanistan's policies and its investments are all related to the geographical location, geostrategic and geoeconomic importance of Afghanistan. The improvement of bilateral relations after 2001 and its rapid increase especially after 2014 indicate that China will be an influential power in Afghanistan shortly. After the US withdrew from Afghanistan in 2021 China became one of the main actor in Afghanistan.

Keywords: Geopolitical Theories, China, Afghanistan, USA, Belt and Road Initiative, Taliban.



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PROTECTING THE CITY OF CULTURE, ART AND SCIENCE PERGAMON (BERGAMA) CASE: ZEUS ALTAR

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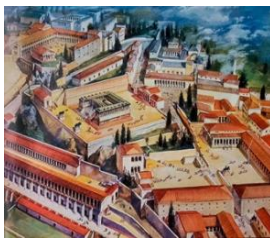
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ABSTRACT

PERGAMON's (today Bergama) urban and archaeological sites; In other words, the historical city that scientists, archaeologists, architects, art historians, urban planners, sculptors and similar men of art and culture have been talking about with admiration, researching, writing about and praising for more than two thousand years, is in danger of extinction in places today. The purpose of this paper is to examine the discovery, transportation and display of the Pergamon Altar of Zeus, one of the most important monuments in the world, which was smuggled to Berlin by archaeologist Carl Humann in the 1870s and exhibited there today in the "Pergamon Museum", and to examine the demands for its restitution today. However, almost 100 years after this monumental artifact was taken, the archeology that continues today in Bergama is to explain the destruction of the area and its lack of protection. As a matter of fact, even today, many valuable archaeological pieces are still used as spolia in constructions. A small museum can be equipped with pieces that a careful eye can see while wandering the streets of Bergama. Today, traditional texture and new Especially; Removing the part of the city center that was previously an urban protected area from the protected area and making a new zoning plan for concentration for this section, Illegal settlements in archaeological areas integrated with the city, especially around Musalla Hill, Military areas located above the archaeological remains, brought the city's traditional urban texture of the Seljuk and Ottoman Periods and the two most important theaters of the Roman Period to the point of extinction.

Keywords: Archaeological Sites, Historical City, Museum.



ZEUS ALTAR IN PERGAMON MUSEUM



PANAROMIC VIEW OF PERGAMON



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AN INVESTIGATION OF RURAL MORPHOLOGY IN PLANNED SETTLEMENT VILLAGES WITH FRACTAL ANALYSIS METHOD: THE CASE OF BÖĞRÜDELİK

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ABSTRACT

Settlements in rural areas have a unique texture with physical transformations and social changes as they develop in the natural process. Planned settlement villages are formed by planning the rural area without developing in its natural process. Planned settlement villages transform and change over time in line with the needs of people in order to achieve their unique texture. Physical transformations and social changes in texture formation in rural areas are determined by rural morphology. Rural morphology includes elements such as street layout, building texture and settlement plan. In this study, it is aimed to examine the rural morphology of planned settlement villages in the historical process and to evaluate them with numerical data. Within the scope of the study, Böğrüdelik Village, which is an example of planned settlement villages within the borders of Konya province, was examined. This village, which was planned to solve the housing problem experienced with the forced migration of Siberian Muhajir Uzbeks between 1908-1910, has undergone physical transformation and social changes over time. In order to reveal this transformation and change, it was aimed to evaluate rural morphology through numerical data and fractal analysis method, which is a numerical data analysis, was used in this study. Fractal analysis was used to analyze the historical change of the road, axis and building texture in the field study in the context of physical transformation and social changes. The impact of these changes and transformations on the texture in rural areas is discussed.

Keywords: Rural Area, Rural Morphology, Planned Settlement, Fractal Analysis.



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PROMOTING CULTURAL HERITAGE FOR SOCIAL SUSTAINABILITY: AN EXAMINATION OF A PUBLIC AWARENESS CAMPAIGN IN AN URBAN SETTING

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ABSTRACT

Collaborative partnerships hold significant potential in enhancing urban social sustainability. This study focuses on promoting cultural heritage to achieve social sustainability within Ankara's urban community. By partnering with Ankara Science University (ASU), Ankara Metropolitan Municipality (AMM) initiates a public awareness campaign, displaying cultural heritage information on city water bills distributed to over 2 million subscribers monthly. The study develops a comprehensive conceptual framework, with the public awareness campaign's impact as the independent variable, exploring its influence on the development of knowledge and positive attitudes among community members. Social sustainability, encompassing overall well-being, inclusivity, and community cohesion, serves as the major dependent variable, assessed within the urban community. Moderator variables include community engagement and existing policies, both evaluated for their role in supporting the campaign's effectiveness in promoting cultural heritage and achieving social sustainability. By leveraging the shared responsibilities of AMM and its partnership with ASU, the campaign's impact is further enhanced. The research question centers on understanding the moderating variables' influence on increased urban cultural awareness. A combination of data gathered through assessments and continuous monitoring of community well-being informs the study's findings, emphasizing the crucial role of public awareness campaigns for fostering social sustainability and the significance of integrating local initiatives.

Keywords: Collaborative Partnership, Cultural Heritage, Public Awareness, Social Sustainability, Urban Community.



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PROCESS MANAGEMENT ANALYSIS IN URBAN TRANSFORMATION PROJECTS WITHIN SCOPE OF 6306 LAWS IN TÜRKİYE: THE CASE OF İSTANBUL BAKIRKÖY

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ABSTRACT

Türkiye is located in the 2nd generation earthquake zone. Especially considering the population density in Istanbul, the consequences of the possible big Istanbul earthquake are predicted to be devastating and affect a large number of people. Today, the building stock in Istanbul is classified as those built before 1980, those built between 1980-2000 and those built after 2000. With the accelerated urban transformation works since 2009, according to the IMM report, 30% of the existing housing stock has been transformed after 2000. (2019, IMM Istanbul Province Probable Earthquake Loss Estimates Update Project Report). After the 2011 Van earthquake, the Law and Regulation No. 6306 on the Transformation of Areas Under Disaster Risk regarding the possible risky structures were published. The published regulation does not include an effective process planning for the transformation processes of risky structures. Currently, 70% of the building stock in Istanbul needs to be converted against possible disaster risk within the scope of Law No. 6306. It is indisputable that the disaster risk is permanent and dangerous and the transformation process needs to be completed quickly. At this point, a case study was conducted regarding the possible disruptions (time, cost) experienced in the transformation processes. A Case study was conducted in scope of the residential building located in Bakırköy district, Baharlı Bahçe Street, no:15 map: 232 block:7 parcel, was completed in the urban transformation project, which was completed within the scope of the law numbered 6306. Semi-structured interviews were conducted with the owners and contractors of the building mentioned in the analysis. During the interviews, it was examined at which stages of the project the time-cost overruns were encountered during the completion of the project. As a result of the interviews, it is aimed to determine at which stages of the ongoing urban transformation projects the problems intensify, and to create a resource for the proposal of process management models.

Keywords: Laws of 6306 Urban Transformation, Project and Construction Management, Process Analysis, Case Study.



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WATER MANAGEMENT IN COMMUNES IN POLAND

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ABSTRACT

Water management in communes in Poland belongs to the commune's own tasks. As part of this task, the commune is obliged to organize the supply of water to residents, as well as the disposal of sewage. Regardless of the legal form of the water supplying entity, until 2018 the level of tariffs was ultimately controlled by the commune council, which approved the level proposed by the said production entity. From 2018, in Poland, this function was taken away from municipalities and the State Water Holding Polish Waters was established, which took over the function of the central controller of the water fee tariff. Many local government officials question the need for such a deep interference in the tariff policy for water and sewage disposal of the central authorities in Poland. In this way, it is accused of reducing the independence and self-government of communes and, from the point of view of social costs, their unnecessary increase due to the additional entity included in the system of production and supply of water to residents. The aim of the article is to assess the legitimacy of centralizing the tariff policy for water supply and sewage disposal in Poland. Although a similar system of central approval exists in relation to electricity prices and is implemented by the Energy Regulatory Office, in relation to the good of water, this may be a debatable matter.

Keywords: Tariff Policy, Water and Sewage, Regulation.



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PROSPECTS FOR THE USE OF AERIAL ROPEWAYS FOR THE ORGANIZATION OF SUSTAINABLE PUBLIC TRANSPORT IN SMART CITIES

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ABSTRACT

Currently, in connection with the UN Sustainable Development Goal No. 11 adopted by the world community, the general direction in the field of modern urbanism is the implementation of the concept of smart cities, which are aimed at achieving environmental sustainability, social sustainability and economic viability. A key role for the successful solution of this problem is the creation smart cities of a sustainable passenger transport infrastructure based on those types of transport that have zero emissions. In this regard, such a type of electric transport as aerial rope systems has good prospects as a sustainable public transport in smart cities. The prospects of its use were investigated within the framework of a grant from the Russian Science Foundation (project No. 22-29-00798). The transition to the use of rope systems provides a significant reduction in CO₂ emissions into the environment. Existing passenger ropeways contribute to the implementation of the principle "car-free cities", contribute to solving the transport problems of cities and increasing the mobility of the population. This is due to the fact that in conditions of dense urban development, the ground tier cannot cope with the growing flow of transport, and the possibility of expanding land highways is limited or simply absent. The transfer of traffic flows to the aboveground space significantly increases the mobility and stability of passenger transportation due to the absence of traffic jams, traffic accidents, the presence of traffic lights and pedestrian crossings, etc.

Keywords: Aerial Ropeway, Sustainable Transport, Smart Cities, Zero Emissions, Mobility.



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EXAMINING THE SUFFICIENCY OF VERTICAL GARDENS IN THE CONTEXT OF RIZE PROVINCE

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ABSTRACT

With the increase in urbanization, the amount of green space needed by individuals is decreasing. Vertical garden applications play an important role in the new living order in order to increase the amount of green space and add both ecological and aesthetic value to the environment. For cities that tend to grow vertically as a result of concreting pressures, vertical gardens should also accelerate with the same acceleration and take their place in the urban landscape with correct and appropriate applications. Vertical gardens, which can be applied on building surfaces and platforms, have many benefits such as screening, cleaning dust particles in the air, heat-sound insulation, orientation and limitation. Vertical gardens reduce the stress of individuals living in cities by reducing the pressures of city life and helping to reduce their physical and psychological problems. They provide a spiritual and physical connection with nature. In the study, vertical gardens in the city center of Rize were chosen as research material. The study was carried out in two stages. In the first stage, the literature related to the subject was searched, and the definition, history, benefits, application systems and examples of vertical gardens were revealed. In the second stage, a survey was conducted with the city users in order to determine the sufficiency levels of the vertical gardens in the Rize city center and to examine their effects on the urban identity, and the results were evaluated.

Keywords: Vertical Garden, Urban Identity, Green Space.



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BICYCLE ROADS AS A SUSTAINABLE TRANSPORTATION AND RECREATIONAL ACTIVITY AREAS: CASE OF RIZE

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ABSTRACT

With increasing environmental problems, the usage of non-motorized vehicles such as bicycles has gradually increased. Beside sustainable transportation, bicycles are also used for recreational and sports purposes. Bicycle roads with adequate infrastructure and built in appropriate sizes provide users a healthy and safe experience. With the bicycle road project in the city center of Rize, an area where local people can participate in sustainable transportation and do sports has been created. Local governments aim to create an uninterrupted bicycle road throughout the city center in addition to this actively used area. The aim of this study is to identify and examine the bicycle roads in the city center of Rize, to identify the problems of bicycle users and to develop suggestions that will increase bicycle use in line with these. In this direction, in the first stage, urban bicycle roads were determined and the necessary measurements were made and the suitability of the paths for use was determined. In the second stage, the opinions and suggestions of the users about the field were taken with the survey study. And with the observations made in the area, the usage changes between night and day and the changes due to the weather conditions were determined. By evaluating the data obtained, suggestions were presented to increase the suitability of the area for use and to increase the use of bicycles in the area.

Keywords: Sustainable Transportation, Bicycle Roads, Rize.



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THE RELATIONSHIP BETWEEN SOUND AND AESTHETICS: AN ASSESSMENT OF BURSA CUMHURIYET AVENUE

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ABSTRACT

The aesthetic term has been a part of the philosophy and psychology disciplines as well as architecture and urban studies recently. Changing technology and social norms also affect the aesthetic notion of the environment. Some other studies also mentioned that socio-demographic, cultural, and historical background impacts the aesthetic. So, while the aesthetic term has been examined in various contexts, the senses perceive it, and visual is the most dominant among others. However, other senses also accompany perceiving and understanding urban life, and the auditory sense is somehow under-explored in conjunction with the aesthetic and urban environment. Auditory sense includes a greater potential for having both physiological and psychological effects on aesthetic concepts. This study aims to assess the auditory perception of the acoustic environment regarding aesthetic concepts. To understand such association, the study performed a quantitative approach on Cumhuriyet Avenue that includes unique historical, social, and built environment attributes in the core city. Next, the researchers identify various aesthetic-oriented scenarios regarding the auditory sense. The study results show that aesthetics and sound have a great association, and sounds can be used for archival and preservation purposes based on the collected sound samples and measurements.

Keywords: Aesthetic, Sound, Auditory.



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HASSAN RAGAB'S SPATIAL ART USING MIDJOURNEY IN THE AGE OF ARTIFICIAL INTELLIGENCE

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ABSTRACT

In this study, it is aimed to understand the position of the artistic spaces created by designer Hasan Ragab using the Midjourney program, one of the increasingly important artificial intelligence technologies, at the intersection of architecture and art. Within the scope of the study, a total of six space models with three different forms and functions were selected using the random sampling method from the artistic spaces created by Hasan Ragab with the Midjourney program. The evaluations of individuals who have received or are receiving education from any of the design disciplines regarding their views on the selected works in the context of creative design principles were analyzed through a detailed questionnaire. The research was applied to a total of 200 participants from 6 different design sub-professional groups. As a result of the research; it was determined that artificial intelligence provides accessibility to many people who do not have artistic skills, Midjourney is a research laboratory that works on artificial intelligence and has created its own program, Midjourney, an online platform, produces art based on a text entered into the software, and an architectural design can be transformed into an artistic work with the use of Midjourney, and it has been determined that the designers who experience the Midjourney platform to create their spatial designs are not in the majority as of today. In addition, according to the expert opinions obtained as a result, the use of Midjourney artificial intelligence program is one of the principles of creative design.

Keywords: Hassan Ragab, Artificial Intelligence, Art, Architecture, Creativity, Midjourney.



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FROM VEHICLE TO SPACE, EXAMPLE OF ADAPTIVE REUSE IN OFFICE DESIGN

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ABSTRACT

The aim of this study is based on the reuse of architectural and industrial parts from different disciplines used for different purposes in new buildings. Sustainable materials used in interior design affect not only material development but also the fundamental transformation of space design to some extent. This study takes materials in the interior and industrial design industry as an entry point, selects adaptable and reusable materials with the concept of sustainability, examines the natural and social properties of materials in depth, and describes the application process of these materials in interior spaces. Two types of materials were used within the scope of the study. As the first material, publications on adaptive reuse with emphasis on theoretical and visual information are publications, thesis studies, lecture notes, architectural and interior design printed publications and internet resources. The scanned and analyzed information is handled from general to specific. As a result of the research, industrial vehicles used for different purposes and the use of independent parts and accessories used in architecture in harmony in interior design are discussed. This study will determine how adaptable reusable materials affect the working comfort of office workers and customers and will be a reference for interior designers in this regard.

Keywords: Office Design, Adaptive Reuse, Interior Design.



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WILD EDIBLE MUSHROOMS AND THEIR BIOACTIVE COMPOUND HAVE REVEALED THERAPEUTIC POTENTIAL AGAINST VARIOUS DISEASES

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ABSTRACT

Since the early days of documented history, people have eaten mushrooms. The Greeks thought that eating mushrooms gave warriors more power in combat, while the Romans thought of them as "Food of the Gods." Mushrooms have long been revered in Chinese culture as a nourishing food and a "elixir of life." They have been a part of human society for countless years, and because of their sensory qualities, they have piqued people's interest in the most significant civilizations in history. They are also known for having appetising culinary qualities. Because they are minimal in calories, carbs, fat, and sodium, as well as being cholesterol-free, mushrooms are valued foods in today's society. These are a good source of minerals including iron and phosphorus, as well as vitamins like riboflavin, thiamine, ergosterol, niacin, and ascorbic acid. They also contain bioactive components such as secondary metabolites (terpenoids, acids, alkaloids, sesquiterpenes, polyphenolic chemicals, lactones, sterols, nucleotide analogues, vitamins, and metal chelating agents) and polysaccharides, primarily beta-glucans and glycoproteins. Biologically active compounds in mushrooms make them potential hepatoprotective, immune-potentiating, anti-cancer, antiviral, and hypocholesterolemic drugs. Due to their low fat and high fibre content, as well as the fact that they are one of the main sources of natural antioxidants beneficial in lowering oxidative damages, they have a tremendous potential to prevent cardiovascular illnesses. The objective of this review is to give readers a thorough understanding of commercially grown,



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wild edible, and medicinal mushrooms as well as detailed information on their phytochemical contents and qualities as food and medicine for potential future use. Future prospects and potential difficulties related to the production and processing of these functional foods are also highlighted.

Keywords: Mushroom, Glycoproteins, Biologically Active Compounds, Functional Foods, Natural Antioxidants.



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APPLICATION OF GREEN ENERGY TECHNOLOGY FOR ENVIRONMENTAL SUSTAINABILITY

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ABSTRACT

Background: Currently, the need of power consumption is important to develop cities and industries. There are numerous traditional methods of receiving the amount of power for the needs but they are threats of environmental pollution. This is why we need to focus on alternative methods of receiving power. **Aim and Objectives:** Green energy can be considered an effective means of promoting the amount of energy needed for industries, urban territories, and businesses without damaging the environment. Green energy is typically derived from renewable energy technologies such as solar, wind, geothermal, and hydroelectric electricity. The best option for improving environmental sustainability and having no negative effects on the nation's economic growth is renewable energy. **Findings:** Notably, one of the primary aims of sustainable growth is to assure the availability of energy sources for future generations while spending as little money and emitting as little pollution as feasible. Green energy has therefore attained the aims of sustainability, i.e., they are the least costly, most effective means to increase the sustainability of a nation's productive sector, people's standard of life, and the environment. **Conclusion:** The main focus of this work is the production, utilization, and implementation of green energy sources globally. We are alone responsible for saving the planet from extinction because we are the ones who pollute it. The article primarily focuses on the advantages, necessity, and need for green technology for a brighter future.

Keywords: Green Energy, Environmental Protection, Renewable Energy Source, Solar Energy, Energy, Geothermal Energy, Hydroelectric Energy, Environmental Sustainability.



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THE GLOBAL BURDEN OF ANTIMICROBIAL RESISTANCE

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ABSTRACT

Antimicrobial resistance (AMR) has become a significant global health issue and poses serious risks to the world's public health and healthcare systems. The worrisome spread of AMR and its significant effects on society are explored in this ABSTRACT. The management of infections that were once manageable becomes more and more challenging as microbial agents continue to acquire resistance to antimicrobial medications, prolonging illnesses, raising mortality rates, and raising healthcare expenditures. The paper investigates the numerous elements causing AMR to spread globally. It draws attention to the indiscriminate use of antimicrobial substances in both human health and agriculture, which has aided in the emergence of resistant microorganisms. The One Health concept also highlights how intertwined human, animal, and environmental health are, emphasising the necessity of coordinated actions to address AMR. In addition, the idea of antibiotic stewardship is emerging as a crucial approach to combat AMR. Healthcare practitioners can prevent the emergence and spread of resistant microorganisms while improving patient outcomes by encouraging prudent antibiotic usage. In this paper the main emphasises on the financial effects of AMR by showing how the growing demand on healthcare systems strains finite resources and compromises the viability of international health efforts. The susceptibility of underserved populations and their lack of access to efficient antimicrobial therapies are also examined, highlighting the significance of equity in healthcare interventions. This ABSTRACT concludes by highlighting the seriousness of the global burden of antibiotic resistance and arguing in favour of proactive steps to lessen its effects. Key elements of the strategy include enhancing surveillance, putting in place programmes for antibiotic stewardship, and raising public awareness.

Keywords: Antimicrobial Resistance, Global Burden, Public Health, Healthcare Systems, One Health, Antibiotic Stewardship.



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EFFECT OF THE INCORPORATION OF PLASTIC WASTE ON THE MECHANICAL PROPERTIES OF COMPOSITE MATERIALS

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ABSTRACT

Through this scientific research, we have tried to study the effect of the incorporation of plastic waste on the mechanical properties of concrete, in order to obtain good concrete with high resistance at a lower cost. To carry out this work, we adopted the following steps: Knowledge of the properties of concrete, which contains plastic waste of High Density Polyethylene (HDPE). Thus, the natural aggregate was replaced by concrete formulated with plastic waste in partial substitution varying between 0%, 10% and 20%. In all the concrete mixes, the components, water, cement, 3/8 and 8/15 gravel and 0/3 sand, remained constant while HDPE waste, varied according to the substitution rate. Through this process, the mechanical properties of concrete in the fresh and hardened state were determined. The analysis of the results of the study allowed us to know the incorporation of plastic waste and its effect on the behavior of the manufactured concrete. The results showed that the density of concrete made from waste plastics is lighter than the reference concrete without waste (C0), which contains only natural aggregates, in the fresh state. In the case of hardening, the results showed a decrease in the compressive strength of the composite concrete produced from plastic waste compared to (C0) the reference concrete.

Keywords: Plastic Waste - Mechanical Properties- Compressive Strength.



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EFFECTS OF POULTRY WASTE GENERATION ON THE ENVIRONMENT IN IKOT EKPENE (RAFIA CITY), SOUTHERN NIGERIA

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ABSTRACT

A study was carried out in Ikot Ekpene, Southern Nigeria to determine the quantity and quality of waste produced in a number of Poultry farms. This is done with the goal of understanding the status of current waste creation in the environment and recommending the best management practices to safeguard the air, surface, and groundwater ecosystem. In the farms, questionnaires focusing on agricultural information and poultry information were given out. Findings from the questionnaires and observations revealed that a total of 2,249,470 birds, or 1,109,600 layers, 743,300 broilers, and 396,570 cockerels are reared annually in confinement at the farms covering an area of 97 acres per hectare. According to calculations, the farms produce 65.76 metric tons of dead birds over the course of a brooding cycle and about 32398kg of poultry trash; Layer's waste - 14735kg, Broiler's waste - 9871kg and Cockerel's waste - 7792kg which excludes litter from slaughterhouses and garbage from hatcheries. Poor waste management is evident in the farms visited, where main waste management practices include burning and indiscriminate land disposal. Few embrace the re-feed strategy, and those that do bury the deceased birds. To protect Ikot Ekpene environment from immediate dangers, this trash generation and control or management system must be modified. For Poultry farmers in Ikot Ekpene, modern management strategies like composting, gasification, and biogas production are advised because they are more environmentally friendly and may produce resources from waste.

Keywords: Poultry Waste, Environment, Agriculture.



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A NEW APPROACH FOR COLORIZATION AND RESOLUTION IMPROVEMENT OF IMAGES

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ABSTRACT

Deep learning techniques have been prosperously applied in many areas of computer vision, including colorization of greyscale images and additionally in amending the resolution of the image. But both of these were never utilized in a cumulated approach to get a super resolution colorized image of a grayscale image. As a component of our major project, we have studied through sundry techniques involved in image colorization and super resolution of the images and propose our amalgamated approach for the colorization of greyscale images and subsequent amelioration of their resolution. In our approach, we mainly focus through two different architectures of neural networks namely, Convolutional Neural Networks and Generative Adversarial Networks. We amalgamated both of these networks to perform Image Colorization and Super resolution respectively. Our model distributes an enhanced colorized image of low resolution grayscale image which was never visually perceived in subsisting models.

Keywords: DIP, CV, MI, Image, Picture.



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A ML BASED APPROACH FOR THE DETECTION OF PHISHING CITES OVER WEB

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ABSTRACT

As we have moved most of our financial, work cognate and other daily activities to the cyber world, we are exposed to more preponderant risks in the form of cybercrimes. URL predicated phishing as ailments are one of the most prevalent threats to the cyber world users. In this type of assailment, the assailer exploits the human susceptibility rather than software imperfections. It targets both individuals and organizations, induces them to click on URLs that look secure, and purloin confidential information or inject malware on our system. Different machine learning algorithms are being utilized for the detection of phishing URLs, that is, to relegate a URL as phishing or legitimate. Researchers are perpetually endeavouring to amend the performance of subsisting models and increment their precision. In this work we aim to review sundry machine learning methods utilized for this purport, along with datasets and URL features used to train the machine learning models. The performance of different machine learning algorithms and the methods used to increment their precision measures are discussed and analysed. The goal is to engender a survey resource for researchers to learn the current developments in the field and contribute in making phishing detection models that yield more precise results.

Keywords: URL, ML, Cybercrimes, Phishing, Learning.



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A NEW APPROACH FOR WEAPON DETECTION UTILIZING THE NOVEL YOLO V3 ALGORITHM

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ABSTRACT

The detection of weapons in public areas become an urges so for cutty Weapon detection sting YOLO is computer application of day Seming to detect weapons in images and videos YOLO v3 is You Only Look Once version 3 is a popular algorithm to find fish fry and poof. The YOLO model works by doing the page is gut of lead the prognosticating Sounding Bees and class causalities for all the Banding or represents an Object in the image, and the data processing designates for blood of flowing in so particular class, such as gun or if other YOLO for weapon detection, the model seats to be mined on a date of my com weapon. The training peruses by adjusting the weights of the seal sworn minimize the intensity between the presaged sounding bones and the ground-bounding Bones in the annotated dataset Ons die 25000 made a mist, it can be set as weapons in authentic-time videos sms or images. The model can be integrated with other security systems, such as alarms or sanitation set sent to law enforcement in case of any detected wagon. With the initiating of computer for public safety detecting weapon in public place. In this paper we propose an approach for fin detection wing de Kus Cny Lank Gray 0060-99) glint. Our approach amends the integrate 2010-03 sigration by our model and got results 77.8 mg50 and 79 m200-95. In summary, weapon detection wing YOLO v3 receive an efficient way many times for public safety and security. The model's accounts good precision and speed range of computers, The dataset covers the data from air and government buildings as as well as private and public places sanctioned for capturing data.

Keywords: DIP, CV, MI, Image, Picture.



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SYNTHESIS AND CHARACTERIZATION OF METAL MOLYBDATES FOR DEGRADATION OF METHYLENE BLUE THROUGH CATALYTIC OXYDATION REACTION

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ABSTRACT

Copper molybdate is among the most studied ternary oxides in the family $AMoO_4$ (A is a transition element or a divalent metal from the alkaline earth column). According to the literature, $CuMoO_4$ possesses five allotropic forms α , β , γ , II and III depending on the synthesis conditions, the temperature and the pressure. Indeed, under atmospheric pressure, the copper molybdate can be detected in two crystalline forms. In fact, it can be in the stable form located at a medium high temperature, α - $CuMoO_4$, in which Mo is tetrahedrally coordinated, or it can have an octahedral coordination in the metastable low temperature (below 190K) form, γ - $CuMoO_4$.



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In this work, we synthesized α -CuMoO₄ in the solid state utilizing a new and simple process, without resorting to any solvent at relatively low temperature. The as-prepared copper molybdate nanopowders were readied through calcination of an oxalate complex in static air at 550°C. The oxalate complex was investigated by TGA and FTIR spectroscopy. The as-readied α -CuMoO₄ was characterized by XRD, and BET technique. Its catalytic effectiveness was verified in the reduction reaction of the nitrophenol isomers. The copper molybdate exhibits exceptionally high reduction reaction of the three isomers of nitrophenol to the three corresponding aminophenol isomers.

Keywords: Ternary Oxides, Oxalate Complex, Copper Molybdate Nanopowders, Reduction of Nitrophenol.



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ENVIRONMENTAL ASSESSMENT OF INDISCRIMINATE REFUSE DISPOSAL IN ARIGBAJO AREA OF OGUN STATE, NIGERIA

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ABSTRACT

Improved economic activities in some parts of Nigeria have led to increased population and this has also increased waste generation in those areas. Ways and manners by which refuse generated from different households are being disposed carelessly on the streets has led to environmental degradation and public health concerns. This present study aimed at assessing the environmental impact of indiscriminate refuse disposal in Arigbajo, Ifo Local Government area of Ogun State, South-Western Nigeria, and was carried out using self administered questionnaires for 60 households within 100metres of the refuse dumps. Solid wastes generated in the study area are composed of paper, rags, metals, food wastes and polythene. The result obtained from the findings shows that numerous open spaces are used as dumpsite which constitute nuisance to the environment. The research revealed that there is no structured waste disposal system in the study area, leading to its vulnerability. It was also discovered that unpleasant smells emanate from the dumpsites and there is prevalence of diseases like malaria fever, cholera, diarrhea and meningitis among the inhabitants. Effect on the Infrastructure is evident due to clogging of water channels by some of the non-biodegradable waste materials such as papers and rags. It is therefore recommended that persistent environmental management campaigns through public health education and adequate funding of solid waste management should be encouraged.

Keywords: Environment, Refuse Disposal, Waste Management, Infrastructure.



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EFFECT OF CELLULOSIC FIBERS ON THE MECHANICAL PROPERTIES OF CEMENT-BASED MORTARS

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ABSTRACT

Cellulose pulp obtained from pulp wood fiber or grasses is pressed, then it is obtained to be dried in flexible sheets. Any kind of paper, cardboard and cardboard that completes its function in all kinds of use and is discarded are defined as wastepaper. In this context, paper mills newspapers published by printing companies are also considered as wastepaper. This study covers the investigation of the effect of waste material on of cement-based mortars. Paper fiber wastes taken by volume in different proportions added to the mortars. Silica fume was used as a pozzolanic binder by replacing the cement in different proportions by volume. The exact values of the proportions was determined by trial mixes. Compressive and flexural strength of mortars were obtained by testing the hardened samples. Among the samples containing paper fiber, the highest compressive strength values were measured as 20.09MPa, 23.99MPa and 28.95MPa for 7, 28 and 90 days samples. While the hydration continues with the curing process strength of the mortar increases over time but the contribution of the fibers in the mortar doesn't increase. Therefore, as the number of the days before specimens are tested increases, the contribution of paper fibers to the mechanical strength decreases by percentage.

Keywords: Mortar, Cellulose, Fiber, Cement, Properties.



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PHYSICAL PROPERTIES OF FIBER REINFORCED GEOPOLYMER MORTARS

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ABSTRACT

Geopolymer composites have recently become a promising ecological alternative to conventional cementitious materials. They are environmentally friendly, and their production requires relatively little energy. The research to examine the use of fibers in geopolymer mortars as well as to reuse the wastes that cause environmental pollution. For this purpose, industrial waste silica fume and basaltic pumice (scoria) were used in the production of geopolymer mortars and were reinforced with wastepaper fibers. In order to determine the physical properties of the produced samples, fresh state unit weight, true density, water absorption, total porosity was obtained by using the relevant tests and formulas. By comparing the obtained data with the control samples, information about usability of cellulosic fibers in geopolymer mortars was obtained. The hydrophilic nature of the paper fibers is the main reason for the water absorption of the geopolymer mortar. Therefore, it was observed that the water absorption percentage increased with the increase in the paper percentage. Since the specific gravity of the fibers in the mortar is 0.93 cm³, the increase in the fiber ratio caused the density to decrease as expected. Increasing the molarity enables the geopolymer matrix to form a stronger, void-free, and tight structure. Therefore, it has a more compact structure compared to the other mixture with a higher molarity than the samples with the same paper content.

Keywords: Physical Properties, Geopolymer, Fiber, Wastepaper, Silica Fume.



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CLAY BRICKMAKING TECHNIQUES (TRADITIONAL – MODERN TECHNIQUES)

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ABSTRACT

The art of crafting clay bricks has been an ancient and well-recognized trade in the realm of construction, dating back to antiquity due to the historical usage of bricks as building materials. In modern times, this technique has evolved significantly, owing gratitude to the advancements in construction technology alongside material knowledge enhancements. Amidst these advancements, the traditional technique of brickwork remains a renowned tradition within small family-owned businesses. These enterprises uphold the fresh application of the age-old methods of brick crafting, a practice that has persisted in Balkan region households until recent decades, whether for personal necessity or commercial purposes. The process of crafting bricks using primitive tools itself holds inherent tradition, yet the amalgamation of traditional practices with modern ones has become a method utilized in my doctoral research. A fragment of this combined approach will be presented within this discourse. The information presented herein is a culmination of research employing various methodologies including analytical, synthesis, statistical analysis, and generalization. This study showcases the method of natural clay selection, its combination with water, mixing techniques, the shaping process, drying, and firing. Consequently, the results will demonstrate the craftsmanship of bricks adhering to European standard dimensions. These outcomes underscore that the fusion of traditional and advanced practices can yield bricks suitable for contemporary construction purposes.

Keywords: Clay, Techniques, Building, Standard, Technology.



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DESIGN OF ELEVATORS AS A VERTICAL CIRCULATION ELEMENT IN HIGH-RISE BUILDINGS

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ABSTRACT

Design of elevators is the most important planning criterion for designing an effective and efficient vertical transportation system in high-rise buildings. Elevators are placed generally in the core in high rise buildings. Thereby the location and number of the core, user's time that takes for reach the elevator, transit time and transportation capacity of the elevators are the basis of elevator design. The aim of this study is to reveal the design approaches of elevators both in vertical and on plan. Considering these approaches will be important for design and application decisions of high-rise buildings. In this study, the user traffic in high-rise buildings was explained. It has been seen that the elevators grouped together increase the efficiency of transportation. Then, the vertical zoning of the elevators and their arrangement on the plan are explained. It has been seen that the vertical zoning of the elevators is important in controlling the elevator number in the building and limiting the space occupied by the core on plan. In terms of grouping of elevators on plan should be considered that user's opportunity to see and reach each elevator cabin in a short time. Elevators which design in central cores are considered advantageous when design provides suitable distance to vertical transportation elements and escape routes for users. Also elevators which design in edge or external cores considered that should be design as multiple for ensure vertical transportation efficiency in long floor plan.

Keywords: Elevator, High-rise Building, Vertical Circulation, Core, User Traffic.



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CREATING A CITY IN METAVERSE: LIBERLAND

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ABSTRACT

The concept of metaverse has been known for decades as a virtual experience place, but the term caught public attention when it was rebranded as “Meta” during Covid-19 and has come to be defined as the future second world. Many cities located on different continents, such as Santa Monica, Seoul and Shanghai have started to develop urbanization strategies through metaverse in order to have a place in the metaverse world. With all these developments, metaverse is predicted to go beyond the ordinary by making radical changes in our lives on different scales, from the life of society to architecture and onwards to the planning of future cities in the near future; it has also raised debates and questions about urban space, context, urban experience-memory and socio-spatial inequalities. In this vein, while adopting a qualitative research method, this study brought together the literature on the metaverse and the subject was discussed with a critical point of view under three headings as the right to the city, the limits of urban and architectural space, and socio-spatial polarization. The subject is examined in detail over Liberland, which is the first metaverse country designed by Zaha Hadid Architects, chosen as the paradigm. As a result, although it is undeniable that the relationship between metaverse, city and architecture has many possibilities and potentials, it has many unknowns in terms of urban experience, contextuality, and integration into physical and daily life.

Keywords: Metaverse, Liberland, Architectural Design.



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ECOLOGICAL CONTRIBUTIONS OF WALKABILITY TO THE CITY

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ABSTRACT

People have tended to migrate constantly from the past to the present. People who migrate and adopt the nomadic life have always been in search of a way of transportation, and they have shaped history by discovering new methods. One of the most fundamental motions that mankind has ever used to perform daily tasks is walking. Studies show that walking is good for human health, both physically and mentally. At the same time, walking reduces the use of motor vehicles, increases the physical activity of people, and reduces the use of fossil fuels in the city. For this reason, the increase in the number of people walking in cities makes a positive contribution to urban people and urban ecology. This situation has revealed the concept of "Walkability". The concept of walkability is defined as "the built environment providing an environment that supports and encourages walking by providing visually interesting vistas that will enable pedestrians to reach certain points in a safe and comfortable way". Creating walkable environments provides people with recreational opportunities while providing solutions to reduce environmental pollution. In this study, it is aimed at emphasizing the contributions of walkable cities to urban ecology and urban health. As a result of the study, suggestions were made for the creation of walkable cities by examining the reduction of harmful gases emitted in the cities by ensuring walkability and its contribution to reducing the carbon footprint and thus preventing climate change.

Keywords: Walkable Cities, Walkability, Urban Ecology, Global Warming, Global Climate Change.



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A LIFE CYCLE ASSESSMENT APPROACH FOR SUSTAINABLE PRACTICES

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ABSTRACT

The intensive use of cement in construction is a significant environmental concern. The cement industry is the primary source of environmental pollution as it intakes a huge amount of energy in the production and releases a lot of CO₂, which contributes to global warming. To reduce the use of cement for energy consumption, the use of supplementary cementitious materials (SCMs) like Fly ash (FA) and Silica fume (SF) in concrete is an interesting solution. FA and SF-based construction materials offer a lot of potential as alternatives to ordinary portland cement (OPC) because of their high performance and environmental friendliness. The level of replacement and the necessity for additional cementitious content are critical considerations when choosing the most sustainable material for concrete production. The present investigation is focused on the development of sustainable concrete using FA and SF as SCMs. Two binary mixes were developed by using FA and SF. The FA was substituted at 20%, 30% and 40%, and SF was substituted at 5%, 7.5% and 10% by weight. The ternary mix is prepared for constant percentages of silica SF like 5%, 7.5 % and 10%, the cement is further replaced with FA (20%, 30% and 40%) by weight to create ternary blended concrete. The mechanical properties such as compressive strength, split tensile strength, flexure strength, and durability characteristics such as sorptivity, rapid chloride penetrability and also micro structure analysis such as XRD, SEM of both binary and ternary mixes were studied. Besides this the cost-benefit analysis, environmental impact assessment and sustainability index for control, binary and ternary blended concrete mixes was also studied. The results of binary mixes show that the incorporation of SF and FA significantly impacts workability. The use of SF considerably increased concrete's early and long-term strength, whereas FA lowered early-age strength; nevertheless, it enhanced long-term strength. It was concluded that the SF contributed to better durability properties than FA. FA at 30% and SF at 10% exhibited the desired strength and durability than OPC. When compared to OPC concrete, the results show that ternary concrete mix containing both FA and SF as a partial replacement for OPC can significantly improve strength and durability. Meanwhile, when compared to control OPC concrete and other ternary mixes, a ternary concrete mix containing 30% FA and 7.5% SF performed better. Furthermore, cost analysis, environmental impact assessment (CO₂ emissions), and sustainability index revealed that concrete built with FA and SF was less expensive, had less CO₂ emissions, and high sustainability than concrete made with OPC. Designing ternary concrete with FA and SF could aid in producing clean and eco-friendly concrete.

Keywords: Cement Construction, OPC Concrete, Fly Ash, Silica Fume, Supplementary Cementitious Merials, Ternary Concrete, XRD, SEM and CO₂ Emissions.



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ECO-LITERACY AND ECONOMIC DEVELOPMENT IN NIGERIA: A SYMBIOTIC RELATIONSHIP

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ABSTRACT

This study explores the intricate relationship between eco-literacy and economic development in the context of Nigeria. Eco-literacy, defined as the understanding of ecological principles and the capacity to make informed decisions for environmental sustainability, has gained increasing significance in light of global environmental challenges. In Nigeria, a country which is rich in natural resources but facing environmental degradation, the interplay between eco-literacy and economic development presents a critical avenue for progress. This paper delves into the multifaceted ways in which eco-literacy can drive economic development. As the nation seeks to diversify its economy beyond oil dependency, embracing eco-friendly practices and industries can foster innovation, create jobs, and enhance global competitiveness. Furthermore, a populace equipped with eco-literacy can advocate for sustainable policies, leading to the preservation of natural resources and reduction of ecological footprints. Conversely, economic development provides a platform to promote eco-literacy. Increased access to education and awareness campaigns can empower individuals with the knowledge to make environmentally conscious choices. Investments in eco-friendly technologies and infrastructures can mitigate environmental degradation and enhance overall quality of life. However, challenges such as inadequate environmental education infrastructure, socio-economic disparities, and policy implementation gaps must be addressed to fully realize the potential of this symbiotic relationship. Through qualitative and quantitative analyses, the paper examines successful eco-literacy initiatives and their impact on economic sectors like agriculture, energy, and tourism. In conclusion, fostering eco-literacy in Nigeria can catalyze a positive feedback loop, whereby economic development drives eco-literacy and vice versa. A comprehensive approach that integrates education, policy, and sustainable practices is essential for harnessing the benefits of this synergy, promoting long-term economic growth, and safeguarding the environment for future generations.

Keywords: Nigeria, Eco-literacy, Economic Development.



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THE ENVIRONMENTAL AND ECONOMIC IMPACTS OF THE USE OF RECYCLED ASPHALT DURING THE PREVENTIVE MAINTENANCE OF ROADWAYS IN THE UAE

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ABSTRACT

Roadways are one of the significant important elements in infrastructure because they are characterized simply as the point of interaction between societies and people. Mainly roadways have been the main source by which whole economies and societies have emerged and developed over the years. They also made a positive contribution to the distribution of ideas, cultures, languages, discoveries, goods, and services of having better and safer roadways. This study seeks to assess the application of recycled asphalt in roadway maintenance by comparing it to the current roadway maintenance procedures in terms of technical parameters in construction procedures, timelines...etc. This will enable the study to identify the possible benefits of using recycled asphalt pavement in roadway maintenance. One of the benefits of using this construction material includes the economic benefits of saving on cost in material consumption, energy conservation in the processes, and environmental protection, which are imperative attributes in the development of sustainable human activities. However, other studies have indicated that asphalt has numerous disadvantages that should be considered before it can be fully adopted. Some of the challenges regard the technical aspects, mechanical considerations, and other quality concerns. This implies that while recycled asphalt can be used as a sustainable material, there is a need to conduct an in-depth analysis to verify and quantify the effectiveness of the material, where the information is limited in the current literature. This study addresses the importance of using recycled asphalt with the integration of road maintenance procedures in the road network. This element is considered the main element of any national infrastructure development plan. The research aims to study and highlight the using recycled asphalt as a suggested sustainable method for road maintenance procedures. Therefore, the study elaborates on the historical use of recycled asphalt, its advantages, and disadvantages. Besides that, the maintenances process categories to ensure the suitable type that ensures the best quality of the network. Since roadway pavement assessment is based on quality as well as different characteristics parameters such as rutting, cracking, pavement quality Index, and roughness. The realization of addressing the factors is an important matter to prevent any threats and challenges during the life cycle of the road network. This can be done by establishing a new implementing process such as using recycled asphalt in pavement rather than the traditional pavement. The new process may provide unique outcomes from environmental, social, and economic perspectives and dedicate policy and strategy to enhancing the quality of roadways. In addition to other parameters. The selected case study for this research is the Dibba-Masafi E89 roadway in UAE where the research methodology is conducted by elaborating the current situation of the roadway performance and the conduct recycled asphalt as solution to ensure better performance.

Keywords: Recycled Asphalt, Roadway Maintenance, Pavement Parameter, Condition Index.



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INNOVATIVE INTEGRATION OF BLAST FURNACE BY-PRODUCTS FOR SUSTAINABLE AND EFFICIENT CONCRETE PRODUCTION

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ABSTRACT

The objective of this study was to explore alternative materials for the production of environmentally friendly concrete. An experimental investigation was conducted to evaluate the mechanical performance of different concrete types using either natural sand or sand derived from blast furnace waste (granulated slag). Three concrete variations were examined: ordinary concrete, concrete with 50% replacement of natural sand with granulated slag, and concrete with 100% replacement of natural sand with granulated slag. Mechanical tests were performed to assess compressive strength, splitting tensile strength, flexural tensile strength, and Young's modulus. The results revealed that the compressive strength of the concrete with 100% granulated slag sand was 25% lower than that of ordinary concrete, but still within acceptable limits. However, the flexural tensile strength of the concrete with 50% granulated slag sand increased by 15% compared to ordinary concrete. It is worth noting that the use of 50% granulated slag sand in the concrete had a detrimental effect on its compressive strength.

Keywords: Mechanical Performance, Granulated Slag, Compressive Strength, Splitting Tensile Strength, Flexural Tensile Strength.



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SIGNIFICANCE OF APPLYING INNOVATIVE CONTEXT-AWARE-BASED ALGORITHMS IN FLEET MANAGEMENT SYSTEMS FOR URBAN MOBILITY

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ABSTRACT

Mobility is of vital importance for urban sustainability, as it affects various aspects of everyday city life. Efficient and sustainable mobility systems reduce congestion, air pollution and carbon emissions. The share of movement of goods in urban traffic can vary significantly based on factors such as the size of a city, its economic activities, transportation infrastructure, and urban planning. However, in many urban areas, the movement of goods accounts for a substantial portion of urban traffic, often ranging from 10% to 30% or even higher. This includes the delivery of goods to businesses, commercial areas, and residences. In this light, efficient goods movement is critical for urban sustainability. Towards this direction, advanced fleet management systems can play a role for urban sustainability by optimizing routes, reducing emissions, and easing traffic congestion. Such systems promote data-driven planning, creating cleaner, efficient, and habitable cities. In the framework of the V-Agrifleet project, a smart fleet management system (Agri.Aware) that is based on a novel context-aware-based algorithm, has been developed. Context awareness can play a crucial role in such systems for promoting urban sustainability, in several ways; optimized routing

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and fuel efficiency, reduced congestion, emission reduction, noise pollution mitigation, to name a few. By utilizing real-time data and promoting informed decision-making, the Agri.Aware system supports efficient and eco-friendlier logistics. The application has a typical three-tier architecture, as shown in Figure 1.

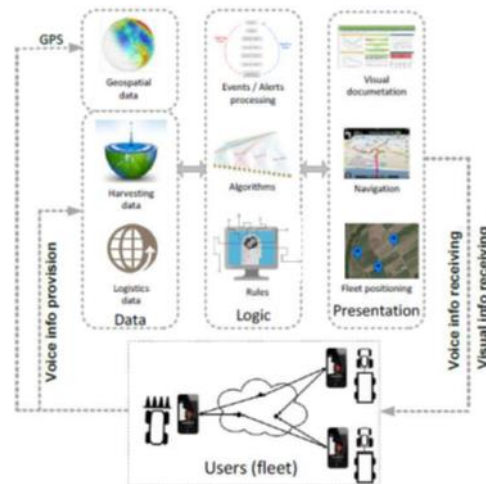


Figure 1: Architecture design of Agri.Aware

At the first level (Tier1), geospatial and logistics data are collected using sensors (GPS receivers and voice command receivers) placed in the fleet. Logistics data refers to information about transport operations, while geospatial data refers to navigation data about the exact locations and speeds of fleet units. At the second level (Tier 2), the above data is integrated in real-time on a centralized basis to support situational awareness and decision-support functions. At the third level (Tier 3), users can access through mobile devices the instructions and navigation data for routing (step-by-step directions), as well as the operating status of the other equipment units. Simulations results indicate the catalytic role of context-aware-based algorithms for sustainable urban mobility. This work has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call Research – Create – Innovate (project acronym: V-Agrifleet; project code: T2EAK-03960).

Keywords: Air Pollution, Carbon Emissions, Traffic.



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FLEET MANAGEMENT SYSTEM FOR OPTIMIZED AGRICULTURAL PRODUCTION IN URBAN ENVIRONMENTS

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ABSTRACT

Fleet management is essential for urban agriculture due to the unique challenges and requirements associated with operating a farming operation within an urban environment. Fleet management is important for various reasons, indicatively; resource optimization, cost control, route optimization, minimization of environmental impact, real-time tracking, scalability, regulatory compliance and data-driven decision making. More specifically, urban agriculture often involves managing various types of vehicles, such as trucks, maintenance vehicles, and agri-machinery. Effective fleet management ensures that all these diverse resources are used efficiently, minimizing downtime and reducing unnecessary expenses. Moreover, in urban areas, traffic congestion can be a significant challenge. Fleet management systems may assist plan optimal routes for vehicles, saving time and reducing fuel consumption. This is especially important for delivering fresh produce on time and maintaining the quality of products. Also, urban agriculture often operates on tight budgets. Fleet management allows for better control of expenses related to fuel, maintenance, and vehicle replacements. By identifying inefficiencies and implementing cost-saving measures, overall profitability can be improved. Apart from economic benefits, fleet management systems also target towards the minimization of environmental impact. With growing concerns about sustainability, efficient fleet management can help reduce the carbon footprint



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of urban agriculture. By optimizing routes and reducing fuel consumption, greenhouse gas emissions are minimized. Real-time tracking of vehicles also provides visibility into their locations and activities. This is particularly useful for monitoring deliveries, ensuring they are on schedule, and addressing any issues that may arise during transit. In addition, urban agriculture operations need to adhere to various regulations, such as vehicle emissions standards and safety requirements. Fleet management solutions can support agri-producers to ensure that agri-machinery and vehicles are compliant with such regulations. Last but not least, as urban agriculture operations grow, managing an increasing number of vehicles and equipment becomes more complex. A robust fleet management system can accommodate scalability, allowing the operation to expand without compromising efficiency. For all aforementioned issues, fleet management is crucial for urban agriculture to streamline operations, enhance resource utilization, reduce costs, and ensure the timely delivery of fresh produce to urban consumers. It enables urban and peri-urban farmers to overcome the unique challenges posed by operating in densely populated areas, while maintaining sustainability and profitability. Towards this direction, the Agri.AWARE fleet management system has been developed. Agri.AWARE is a decentralized fleet management system that provides real-time information exchange between all involved individuals and machinery in agricultural production. The system can collaborate in heterogeneous fleets, regardless of manufacturer brand and specification of machinery. The tool supports operators by automatizing interaction with the system, allowing them to verbally interact with fleet users through voice commands. The Agri.AWARE system offers a cost-effective technology for agri-fleet management with voice commands and automatic decision-making, by providing operational status for each individual unit of the fleet, through the incorporation of the system's context awareness module. Agri.AWARE provides significant comparative advantages over existing fleet management technologies, since it is a sustainable solution (economically feasible and environmentally friendly) that holistically covers the needs of agricultural businesses and farmers for the optimal utilization of their equipment. This work has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call Research – Create – Innovate (project acronym: V-Agrifleet; project code: T2EAK-03960).

Keywords: Urban Environment, Agri.AWARE, Agricultural Production.



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ENHANCEMENT FACTOR FOR CO₂ ADSORPTION INTO PROMOTED POTASSIUM CARBONATE SOLUTION

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ABSTRACT

For the purification of gases or to obtain new products, the absorption method is recommended for the removal of acidic impurities from gases. The chemical reaction absorption (chemisorption) can be carried out in a variety of solutions, including ammonia solution, aqueous amine solution, potassium carbonate solution, etc. Because of its benefits, such as affordability, ease of regeneration, nontoxicity, and non-corrosiveness, chemisorption in potassium carbonate solution with the addition of amines, as promoters, at a temperature of 70 to 80°C has been utilized more frequently. The presentation of the amine-supported post-combustion CO₂ capture in potassium carbonate solution. As amines were considered DEA, MDEA and TETA. The enhancement factor value (a ratio of the rate of CO₂ absorption in the presence of a chemical reaction to the rate of absorption in the absence of a reaction at same concentration driving force) was used to evaluate the efficacy of amines. Carbonate mass fractions between 0.1 and 0.4 and amine mass fractions between 0.018 and 0.04 were taken into account for simulation. The enhancement factor values obtained for the chemisorption in solution promoted with considered amines were values between 1.5 and 6.4, the higher for MDEA. Experimental data demonstrated that MDEA can be successfully used in the industrial applications - chemisorption processes, being more efficient, especially for high fluid flow rates. As results, we recommended potassium carbonate solution mass fraction 0.25 promoted with 0.04 MDEA.

Keywords: Chemisorption, MDEA, Potassium Carbonate Solution.



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NANOSTRUCTURED SnO₂ PREPARED BY SOL-GEL METHOD AND IT'S APPLICATIONS

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ABSTRACT

The metal oxide SnO₂ is a typical wide band n-type semiconductor $E_g = 3.6$ eV at room temperature and is used in applications such as gas sensors, electrode materials and catalysts, in lithium ion batteries or solar cells. The purpose of this study is to obtain SnO₂ crystals from aqueous solutions, although SnO₂ nanostructures were prepared based on the sol-gel method with Tin (IV) chloride pentahydrate (SnCl₄•5H₂O). The samples were characterized by methods such as scanning electron microscopy (SEM), transmission electron microscopy TEM micrograph and EDS and X-Ray Diffraction (XRD). The samples were calcined at temperatures of 600 °C. The particle size of all samples was in the range of 28-92 nm calculated according to Scherrer equation. On the base of obtained materials properties the main application domains are presented and an deep analysis of these are provided.

Keywords: Sol-Gel Method, SnO₂ Nanoparticles, Characterization, Applications.



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PHYTO-SYNTHESIS OF ZnO/Co₃O₄/MoO₃ NANOCOMPOSITE: AN EFFICIENT ZnO/Co₃O₄/MoO₃/NAFION/ GC ELECTRODE

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ABSTRACT

The synthesis of metal oxides nanocomposite using biological methods is an emerging eco friendly and sustainable attractive. The current study focuses on the production of ZnO/Co₃O₄/MoO₃ nanocomposite (ZCM-NC) using the aqueous leave extracts of Ficus Moraceae. The leave extracts were found to be rich in phenols which were confirmed by the spectroscopy analysis thereby enhancing the biogenic synthesis of ZCM-NC. The prepared ZCM-NC was characterized by UV-vis absorption spectroscopy, Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD), and scanning electron microscopy (SEM). The Scanning Electron Microscope with the Energy Dispersive X-ray studies were used for characterization that provides the size and the elemental composition of the synthesized ZCM-NC. The average size of the nanoparticles was found to be 30-50nm. The FTIR analysis played a pivotal role in displaying the important functional groups present in the ZCM-NC nanocomposite, which showed that the sample had strong absorbance in the range of 1600–1450 cm⁻¹. The electrochemical behavior performances of ZCM-NC/GCE were evaluated by cyclic voltammograms and EIS method. These results showed a ZCM-NC/GCE to be a promising electrode for electrochemical applications. The overall study reveals the biogenic synthesis of ZnO/Co₃O₄/MoO₃ nanocomposite using Ficus Moraceae, can be an alternative to chemical synthesis for the fabrication of effective electrodes.

Keywords: Phyto-synthesis, Ternary Nanocomposite, Electrode: Cyclicvoltammogram.



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SYNERGIZING AI AND INDUSTRY 5.0: FOSTERING COLLABORATIVE INNOVATION FOR SUSTAINABLE GROWTH

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ABSTRACT

This research delves into the dynamic amalgamation of Artificial Intelligence (AI) and Industry 5.0, with a central focus on catalyzing collaborative innovation in the pursuit of sustainable growth. The study undertakes a comprehensive exploration of the integration of AI within the Industry 5.0 framework, shedding light on the intricate interplay between human and machine collaboration. A critical facet of this investigation involves scrutinizing AI's transformative potential in augmenting human capacities, bolstering productivity, and germinating novel paradigms of business operations. The research deeply engages with the ethical dimensions and societal ramifications entailed by the infusion of AI within Industry 5.0 contexts. Drawing insights from real-world case studies and empirical evidence, the study delineates pivotal determinants for successful AI implementation, navigates prevailing challenges, and distills optimal strategies for harnessing AI's collaborative potency within the Industry 5.0 landscape. The culmination of this research manifests in a compendium of insights tailored for organizational and policymaking stakeholders, offering pragmatic recommendations to harness the symbiotic nexus of AI and Industry 5.0. Emphasis is laid on leveraging this synergy to propel collaborative innovation and engineer sustainable growth trajectories. While Industry 5.0 embodies ideals of human-centricity, socio-environmental sustainability, and resilience, a nuanced understanding of the mechanisms by which these ideals materialize remains incomplete. In essence, this study unfurls the potential of AI and Industry 5.0 synergy as a cornerstone for fostering collaborative innovation and steering the course toward sustainable growth in a rapidly evolving technological landscape.

Keywords: Artificial Intelligence, Industry 5.0, Collaborative Innovation, Sustainable Growth.



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EVALUATION IMPACT CLIMATE CHANGE ON LETTUCE HYDROPONIC MSMES (STUDY CASE ALAM TANI HIDROFARM KUDUS)

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ABSTRACT

Change in climate have a significant impact on various aspects of work, especially in the modern agricultural sector. Therefore, the Alam Tani Hidrofarm Kudus Sector faces new challenges in the production process. This study aims to describe and evaluate the effect of climate change on the growth of vegetable plants in Alam Tani Hidrofarm Kudus. The research method used is qualitative research with a case study approach. Data obtained through observation, in-depth interviews, and document collection. The result showed that climate change produces various impacts such as decreased productivity and quality in hydroponic lettuce plants. Factors such as temperature extremes, variations in rainfall, pests and fungi play a role. However, this study also identified various evaluations for increasing the productivity and quality of hydroponic lettuce. These solutions include implementing regular irrigation systems, using greenhouses, careful monitoring, using technology, and so on. This effort aims to deal with climate change both now and in the future.

Keywords: Climate Change, MSMEs, Hydroponic.



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PERAN DIGITAL MARKETING TERHADAP PENINGKATAN PENDAPATAN UMKM ALAM TANI HYDROFARM DI KUDUS

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ABSTRACT

This research was conducted due to the acceleration of globalization which has driven the rapid development of digital technology, providing opportunities for businesses to enter the digital marketing market. Therefore, UMKM Alam Tani Hydrofarm can increase their income through digital marketing strategies. The purpose of this research is to understand the role of digital marketing in increasing the income of UMKM Alam Tani Hydrofarm in Kudus. This study uses a qualitative descriptive approach, which aims to provide facts and data regarding the effect of digital marketing on the income of UMKM Alam Tani Hydrofarm. The results of this study indicate that digital marketing implemented by UMKM Alam Tani Hydrofarm has a significant impact. These UMKM actors can continue to develop their business while meeting consumer needs through digital marketing strategies. The transition to purchasing through digital marketing will also facilitate market expansion for UMKM. Current technological developments optimize the potential of UMKM and promote sustainable growth. Social media and e-commerce platforms are important means of increasing UMKM sales.

Keywords: Digital Marketing, Income, UMKM.



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ANALISIS SWOT DALAM STRATEGI PENGEMBANGAN UMKM PETANI SELADA (STUDI KASUS UMKM ALAM TANI HIDROFARM KUDUS)

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ABSTRACT

This study aims to determine the strengths, weaknesses, opportunities, and threats that affect Alam Tani Hidrofarm Kudus. The method used in this research is qualitative. The data used in this study is primary data by conducting interviews and observations at UMKM Alam Tani Hidrofarm Kudus. The results of this study indicate that the strengths possessed by Alam Tani Hidrofarm Kudus are reducing dependence on large agricultural land, products having good quality, appropriate market segmentation. These weaknesses include the unstable availability of hydroponic lettuce to meet vegetable demand, less variety of vegetable products, and the risk of technical failures in hydroponic systems that can disrupt production. While the opportunities that are owned are customer loyalty, high market demand for cleaner agricultural products, and a wider marketing network. The threats are the emergence of competition with agricultural products that may be cheaper, uncertainty in marketing, uncertain climate change, and unstable demand levels. Based on the results of the SWOT matrix analysis of internal factors (strengths and weaknesses) and external factors (opportunities and threats) of Alam Tani Hidrofarm Kudus, twelve alternative strategies were obtained consisting of the SO strategy, W-O strategy, S-T strategy and W-T strategy which can be implemented.

Keywords: SWOT, Strategy, UMKM.



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RESILIENCE AND PSYCHOLOGICAL WELLBEING AMONG YOGA-PRACTITIONERS AND NON PRACTITIONERS

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ABSTRACT

The term "yoga" is used to describe a collection of mental, physical, and spiritual practices that are thought to have originated in ancient India. It is believed that practicing yoga can bring harmony between the mind and body. Further, people who are resilient are not immune to experiencing distress or negative emotions, but they maintain optimism. To keep a confident viewpoint, expecting beneficial things and to exercise regularly for body and mind care are some of the ways to build the resilience. The psychological well-being has the potential elements like, happiness, perkiness, idealism, restraint, independence from dissatisfaction, nervousness and wretchedness (Tellegen, 1979; Sinha and Verma, 1992). The aims of the study were to investigate the difference between yoga practitioners and non-practitioners with regard to their resilience ability and psychological wellbeing. 30 yoga practitioners and 30 non-practitioners in the age range of 20-70 years gave their consent to participate in the research and responded on the resilience and psychological wellbeing scales. The significant differences were observed between resilience ability of yoga practitioners ($M=75.20$, $SD=12.38$) and non-practitioners ($M=61.28$, $SD=13.63$). Similar differences were also reported for psychological wellbeing among the two groups. Further the responses on six dimensions of the psychological wellbeing were also explored.

Keywords: Yoga, Resilience, Psychological Wellbeing, Exercise, Mind, Body.



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PREPARATION AND CHARACTERIZATION OF 45S5 BIOGLASS FROM RICE HUSK ASH AND EGGSHELL ASH AS ALTERNATIVE RESOURCES BY MICROWAVE ENERGY ASSISTED MELT-QUENCHING APPROACH

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ABSTRACT

This work presents a novel approach for the preparation and characterization of 45S5 bioglass using rice husk ash (RHA) and eggshell ash (EGSA) as alternative resources at varying inclusions. The traditional method of producing bioglass involves the use of costly raw materials, such as silica and calcium carbonate. In this study, RHA and EGSA, which are abundant agricultural waste products, are utilized to synthesize 45S5 bioglass through a microwave energy-assisted melt-quenching approach. The obtained bioglasses were characterized for their structure, mechanical, morphology, and bioactivity. The results showed that all the developed bioglasses exhibited an amorphous broad hump structure. The morphology showed irregular morphology containing heterogeneous grains, rough and porous surface respectively essential for bone in-growth and cell infiltration while a cauliflower-like appearance of carbonate-hydroxyapatite was well pronounced on all the samples after immersion in simulated body fluid. The developed bioglasses also showed considerable micro-hardness and compressive strength to justify their use for biomedical applications.

Keywords: 45S5 Bioglass, Microwave Energy, Melt-Quenching, Rice Husk Ash, Eggshell Ash.



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EVALUATION OF THE PERFORMANCE OF THE FPS SYSTEM IN CONTROLLING THE SEISMIC RESPONSE OF THE MEDIUM-RISE BUILDING

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ABSTRACT

With the aim of enhancing the structural performance of a mid-rise building exposed to exceptional seismic forces, passive base isolation systems have proven to be indispensable components of the architectural design. Among these solutions, the choice leans towards the FPS (Friction Pendulum System) base isolator. This type of friction pendulum support exhibits a highly nonlinear behaviour, limiting the transfer of shear forces through the isolation interface and consequently facilitating substantial energy dissipation. The objective of this study lies in the performance evaluation of the passive FPS system. To this end, an exhaustive parametric study was undertaken, taking into account a multitude of parameters including various seismic excitations of various natures. The results of this nonlinear dynamic analysis highlight exemplary performance of the FPS system. Indeed, a significant reduction in the structural responses, namely the relative displacements, as well as the relative accelerations of the top floor. Also, a notable reduction in inter-stories displacement was observed. This configuration allowed considerable energy dissipation, thus confirming the excellent performance of this system in order to optimize the structural robustness of a mid-rise building.

Keywords: Base Isolation, FPS (Friction Pendulum System), Seismic Excitation, Nonlinear Analysis, Hysteresis Curve.



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A STUDY OF TWO PARAMETERS BASED FLEXIBLE PROBABILITY MODEL WITH PROPERTIES AND APPLICATIONS

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ABSTRACT

Statistical analysis of lifetime data is an important topic in reliability engineering, biomedical and social sciences and others. In this paper, a new one-parameter unit probability distribution called new unit rational sine distribution is proposed. It is more flexible than some existing well-known distribution due to its different shapes of the hazard function and probability density functions. We study some of its statistical properties. We obtain explicit expressions for moments, quantile function and order statistics. The method of maximum likelihood is used to estimate the model parameters. The parameters related to the proposed distribution are estimated using well known estimation methods. A numerical simulations study is conducted for reinforcement of the results. In the end, we considered three real data sets to illustrate the applicability of the proposed model. Statistical distributions are of immense importance to describe and predict the phenomenon of real world. In several logical analysis, the selection of a suitable statistical model is required. Though, a number of distributions have been developed, but there is always room for developing distributions, either having more flexibility in terms of shapes or fitting to the real world situations. Probability distributions are developed for solving different real world problems in different areas, some of the distributions are defined on the positive real line and some are defined on the whole real line.

Keywords: SH Distribution, Order Statistics, Maximum Likelihood Method, Monte Carlo Simulation.



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STUDY OF THE FEASIBILITY OF PRODUCTION OF TITANIUM OXIDE AS A POROUS SUPPORT FOR WHOLE CELLS IMMOBILIZATION WITH ENZYMATIC ACTIVITY

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ABSTRACT

Titanium oxide (TiO₂), known as titania, is an advanced ceramic material, considering it is produced from high purity synthetic raw materials. This material is found in three distinct polymorphic phases: rutile, anatase and brookite. Rutile is the most common and the most stable among them, being the material selected for use in the present research. The choice of titanium oxide was primarily due to the fact that it is a compound that has been standing out in several studies with regard to advanced ceramics. Furthermore, TiO₂ presents interesting characteristics for the formation of porous pieces, considering, above all, its high melting temperature, which implies a high sintering temperature, and consequently, the resistance and good stability of the materials produced. In this work, porous titania supports were



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produced using the replica technique, in order to find a better porosity for later application of supports. Studies were carried out on the composition and rheology of titania slip from the variation of water, titania and additives contents; conformation, using polyurethane sponges as the material to be replicated with two different porosities (30 and 40 ppi); and drying and burning based on the variation of heating rates, burning temperature and levels, aiming at optimizing the process. So far, the composition and firing condition of the slip have been obtained for the production of porous titania pieces that ensure good mechanical resistance and a previously established large-scale production route. In addition, studies have showed the application of TiO₂ for the immobilization of microbial cells for fructooligosaccharides production.

Keywords: TiO₂, Porous Ceramics, Advanced Ceramics, Replica Technique.

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PHASE BEHAVIOR AND ROLE OF ORGANIC ADDITIVES FOR SELF-DOPED CSPBI₃ PEROVSKITE SEMICONDUCTOR THIN FILMS

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ABSTRACT

The phase change of all-inorganic Cesium lead halide (CsPbI₃) thin film from yellow δ - phase to black γ/α - phase has been a topic of interest in the perovskite optoelectronics field. Here, the main focus is how to secure a black perovskite phase by avoiding a yellow one. In this work, we fabricated a self-doped CsPbI₃ thin film by incorporating an excess Cesium iodide (CsI) into the perovskite precursor solution. Then, we studied the effect of organic additives such as 1, 8-diiodooctane (DIO), 1-chloronaphthalene (CN), and 1, 8-octanedithiol (ODT) on the optical, structural, and morphological properties. Specifically, we employed the Flory–Huggins theory based on the oligomer level of additives' molar mass to elucidate the binary additive-solvent solution thermodynamics. Resultantly, we found that the miscibility of additive–solvent displaying an upper critical solution temperature (UCST) behavior is in the sequence CN: DMF > ODT: DMF > DIO: DMF, the trends of which could be similarly applied to DMSO. Finally, the self-doping strategy with additive engineering should help fabricate a black-phase perovskite although the mixed phases of δ -CsPbI₃, γ -CsPbI₃, and Cs₄PbI₆ were observed under ambient conditions. However, the results may provide insight into the stability of metastable-phase CsPbI₃ at room temperature.

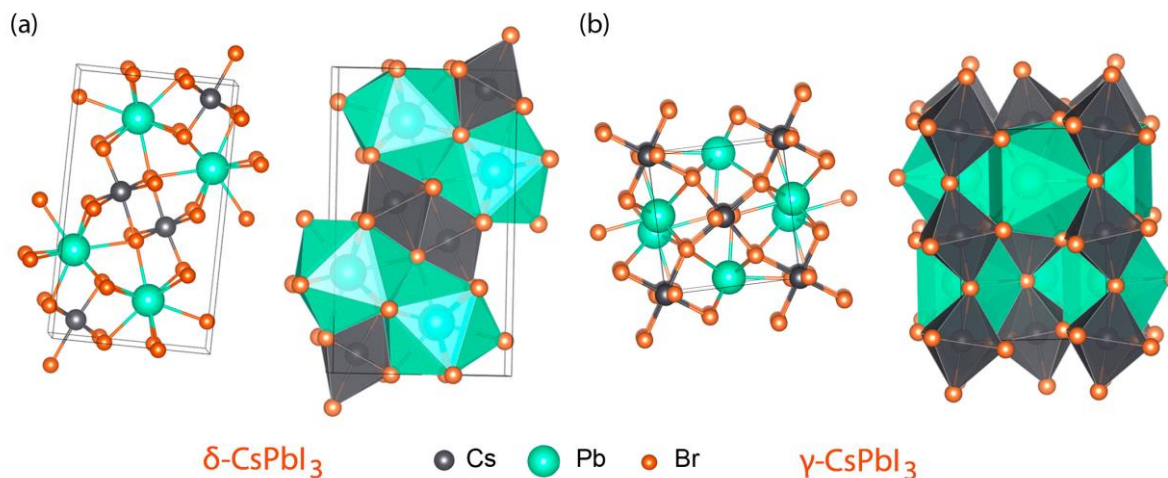


Figure1. Crystal structures of (a) yellow δ -phase CsPbI₃ and (b) black γ -phase CsPbI₃



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APPLICATION OF ARTIFICIAL INTELLIGENCE IN DIFFERENT ASPECTS OF FUNDAMENTAL SCIENCES

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ABSTRACT

Over the past two decades, artificial intelligence research has significantly improved the performance of both manufacturing and service systems. This paper presents the state-of-the-art in artificial intelligence in an integrated, concise manner to demonstrate expertise in the field. In particular, this paper provides a broad overview of recent developments in the field of artificial intelligence (AI) and its applications. Artificial intelligence (AI) and machine learning (ML) techniques are widely influencing many aspects of various fields, including science and technology, industry, and even our daily lives. This paper provides a comprehensive survey of the development and application of artificial intelligence in various aspects of the fundamental sciences, including information science, mathematics, medical science, materials science, geoscience, life science, physics, and chemistry. The challenges faced by each discipline of science and the potential of AI techniques to overcome these challenges are discussed in detail. Despite the widespread use of artificial intelligence in a wide range of applications, there are still ML security risks to data and ML models as attack targets during both the training and execution phases. First of all, since the performance of an ML system is highly dependent on the data used to train it, this input data is critical to the security of the ML system. Although many protection techniques have been proposed against these security threats, new attack models targeting ML systems are constantly emerging. Thus, it is necessary to address the ML security problem and develop robust ML systems that remain effective in the face of malicious attacks.

Keywords: Artificial Intelligence, Machine Learning, Neural Network, Genetic Algorithms



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CARBON NANOHORNS -BASED MATRIX NANOCOMPOSITE FOR CD (II) AND HG (II) REMOVAL FROM WASTEWATER

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ABSTRACT

Water pollution by heavy metals cations such as Cd(II) and Hg(II) are likely to cause serious damage to human health due to their non-degradation behavior and high level of toxicity. In the last years, a lot of sorbent – based nanocarbonic materials for water decontamination through dispersive solid phase extraction (DSPE) have been developed and synthesized. This paper reports synthesis of a thiolated polystyrene - thiolated carbon nanohorns as novel matrix nanocomposite used as sorbent for Cd(II) and Hg(II) removal from waste water. These materials are robust, sensitive, stable in harsh environments. Furthermore, thiolated carbon nanohorns exhibit outstanding properties that recommend them for use as adsorbents in wastewater decontamination: uniform size, large surface area, selectivity. This matrix nanocomposite was designed according to HSAB theory (a hard base prefers to bind to hard acid, soft bases prefer to interact to soft acids, while a borderline bases tend to bind to borderline acids). From the HSAB concept point of view both Cd (II) and Hg(II) cations are classified as soft acids and it is easy to predict that these cations tend to interact with soft bases such as thiol group. Both materials were synthesized from polystyrene and pristine carbon nanohorns using H₂S, propanethiol (CH₃CH₂CH₂SH) or thiophene plasma functionalization. The synthesized materials were characterized by several techniques, including Raman spectroscopy, FTIR spectroscopy and X-ray photoelectron spectroscopy. The new matrix nanocomposite will be synthesized using an ultrasonical bath and an appropriate solvents.

Keywords: Carbon Nanohorns, Plasma Functionalization, Waste Water.



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NOVEL RESISTIVE AMMONIA SENSOR

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ABSTRACT

This paper reports the design and manufacturing processes for a resistive ammonia sensor, employing binary nanocomposites consisting of fluorinated nanocarbon materials (CNHs-F) / polypyrrole (PPy), fluorinated onion-type nanocarbon materials (CNOs-F)/ PPy, as well as CNHs-F/CNOs-F/PPy ternary nanocomposites as sensing layers, a dielectric substrate and electrodes. The functionalization of carbon nanohorns, as well as onion-type nanocarbonic materials is achieved by F₂-N₂ plasma treatment. Polypyrrole can be used as a 5% aqueous dispersion (commercial product) or it can be synthesized in situ by a chemical polymerization reaction using pyrrole (monomer), FeCl₃ (oxidizing agent) and sodium p-toluenesulfonate (doping agent). Through the ad/absorption of ammonia molecules, electrons are transferred to the nanocarbon structure. Both CNHs-F and CNOs-F are p-type semiconductors, the number of holes decreases, therefore the resistance of the nanocarbon material increases proportionally. Polypyrrole is also a p-type semiconductor and by ad/absorption of ammonia molecules, the number of holes decreases, therefore the resistance of the polymer increases proportionally. The functionalization of carbon nanohorns and onion-type nanocarbonic materials in F₂-N₂/ plasma has the advantage (by varying the exposure time as well as its power) that it can ensure an optimal C:F ratio. The dielectric substrate is glass, electrodes are deposited on the surface of the dielectric substrate by direct printing, sputtering, or evaporation. The electrodes can be made of the same material (gold, platinum) or of different materials. They can be linear or have an interdigitated configuration.

Keywords: Ammonia Resistive Sensor, Carbon Nanohorns, Polypyrrole.



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THIOLATED CARBON NANOHORN AS SENSING LAYERS FOR SURFACE ACOUSTIC WAVE HYDROGEN SULPHIDE SENSOR

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ABSTRACT

This paper reports the design and manufacturing processes for a surface acoustic wave (SAW) H₂S sensor, employing thiolated carbon nanohorns, (abbreviated as CNH-SH) as sensing layer, a quartz piezoelectric substrate and interdigital transducers. Pristine carbon nanohorns, purchased from Sigma Aldrich, are functionalized in H₂S/He plasma (volumetric ratio 60-40), with a plasma power of 30 W, at an exposure time of 5 minutes. The sensor used is of the "delay line" type, made on a quartz piezoelectric substrate. The sensor features a dual delay line to compensate for thermal drift. Thus, one delay line is covered with CNH-SH, the second delay line being the piezoelectric substrate itself (quartz without sensitive layer). To obtain a signal due exclusively to the chemical interaction CNH-SH - H₂S, the signal associated with the delay line without the sensitive layer can be subtracted from the signal of the delay line covered with CNH-SH (differential scheme). The use of functionalized nanohorn type films gives the sensor several significant advantages: superior mechanical properties; the presence of CNH-SH confers a high specific surface / volume ratio, affinity for H₂S molecules through van der Waals-type interactions ("mass loading"), as well as a variation in the resistance of the sensitive layer upon contact with them ("electric loading"); fast response of the sensor to variations in the H₂S concentration value; fast response of the sensor to variations in the H₂S concentration value; reversibility; detection at room temperature.

Keywords: SAW Sensor, Hydrogen Sulphide, Thiolated Carbon Nanohorns.



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THIOLATED CARBON NANOONIONS AS SENSING LAYER FOR RESISTIVE HYDROGEN SULPHIDE SENSOR

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ABSTRACT

This paper reports the design and manufacturing processes for a resistive H₂S sensor, employing thiolated carbon nanoonions (abbreviated as CNO-SH) as sensing layer, a dielectric substrate and electrodes. CNOs are synthesized from nanodiamond, by thermal treatment at 1650°C, in a helium atmosphere. CNO-SH are synthesized through functionalization of pristine CNOs in H₂S/He plasma (volumetric ratio 70-30), with a plasma power of 40 W, at an exposure time of 4-6 minutes. The optimal degree of derivatization of the nanocarbonic materials, in order to obtain high sensitivities, can be modulated by varying the plasma power as well as the exposure time. The dielectric substrate is Kapton and can be between 50 microns and 5 millimeters thick. Electrodes can be deposited on the surface of the dielectric substrate by direct printing, sputtering or evaporation. The electrodes can be made of the same material (gold, chrome) or of different materials. They can be linear or have an interdigitated configuration. The use of CNO-SH as sensing layer films gives the sensor several significant advantages: superior mechanical properties; the presence of CNOs-SH confers a high specific surface / volume ratio, affinity for H₂S molecules through van der Waals type interactions as well as a variation in the resistance of the sensitive layer upon contact with them; fast response of the sensor to variations in the H₂S concentration value; detection over a wide temperature range; reversibility.

Keywords: Thiolated Carbon Nanoonions, Resistive Sensor, Hydrogen Sulphide.



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VEHICLE TO VEHICLE COMMUNICATION USING LIFI TECHNOLOGY

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ABSTRACT

The most effective way to lower accidents is through vehicle-to-vehicle communication using Li-Fi technology. In this study, light-emitting diode bulbs are the main suggested application for Li-Fi technology, with data being delivered over the light spectrum as an optical wireless channel for signal propagation. With the use of this technology, traffic accidents can be averted and several lives can be saved. This project involves a variety of sensors, including an accelerometer, an ultrasonic sensor, and a speed sensor, and it transports the information gathered from these sensors across cars. Through this LI-FI, information can be sent between vehicles. Over LIFI, any kind of data, including text, audio, and video, can be exchanged. With lowest expense and greatest effectiveness, this concept can be put into practice. The widespread usage of LED-based lighting in modern life means that it can also be utilized for communication because of its benefits including quick switching, high power efficiency, and protection of human vision. In order to communicate data between automobiles in an eco-friendly manner, this project will use visible light, which is composed of white LEDs that transmit audio signals to the receiver. The future of VLC is promising, because it complements present RF communication by improving efficiency.

Keywords: Communication, Propagation, Optical.



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CORROSION AND MICROSTRUCTURE BEHAVIOUR OF ELECTRICAL DISCHARGE COATED AZ91 MAGNESIUM ALLOY FOR BIOMEDICAL APPLICATION

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ABSTRACT

Magnesium and its alloys play important role in the fields of biomedical such as implant, due to its good bio degradability. However, accelerated corrosion rate in intro environment leads to implant failure by losing the mechanical integrity before complete restoration. In the investigation, hydroxyapatite (HA) coatings were created on the AZ91 magnesium alloy by utilising the electrical discharge coating technique. During the coating of magnesium alloy, different factors such as discharge current, pulse on time and pulse off time were controlled. Coating composition, surface topography and degradation in simulated body fluid (SBF) of the electrical discharge coated specimens were evaluated. It is revealed that the coating layer thickness increased to 82 μm , as increase in current and pulse on time, whereas, when increase the pulse off time. Electrochemical tests show that the E_{corr} of Mg substrate positively shifted about 300~500 mV and i_{corr} lowers more than 100 times after electrical discharge coating. Though, the HA coatings formed in the higher current and pulse on time indicate an increasing worse corrosion resistance compared with that of the base AZ91 magnesium alloy, which is possibly attributed to the increasing amorphous components caused by HA involvement.

Keywords: Electrical Discharge Coating, AZ91 Magnesium Alloy, Hydroxyapatite, Corrosion Resistance.



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CYCLOHEXANE-1,3-DIONE DERIVATIVES FOR PROSPECTIVE ANTI-NSCLC CANCER EFFICACY THROUGH INTEGRATED QSAR AND DOCKING EXPLORATIONS

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ABSTRACT

In this study, we explored the quantitative correlation between the effectiveness against non-small cell lung cancer (NSCLC) and the molecular configuration of a set of 38 derivatives based on cyclohexane-1,3-dione-dimidone. To achieve this objective, we employed molecular characteristics determined through DFT-B3LYP/6-31G calculations, along with topological and physicochemical analysis. The outcomes of the assessments for the QSAR models developed in this research using MLR and MNLN techniques reveal the substantial predictive capacity of these models. For the linear model, the coefficients of determination were ($R^2 = 0.913$; $R^2_{cv} = 0.85$; $R^2_{test} = 0.934$), and for the nonlinear model, they were ($R^2 = 0.991$; $R^2_{cv} = 0.82$; $R^2_{test} = 0.997$). Leveraging predictions stemming from the QSAR model, novel molecular structures were conceptualized. Their efficacy against NSCLC was gauged, and the principal interactions between these molecules and the human c-Met protein were anticipated. The amalgamation of forecasts from the QSAR models, molecular docking, and the evaluation of in silico ADMET properties indicated that one out of the sixteen newly conceived molecules holds potential as a prospective drug for NSCLC.

Keywords: QSAR, ADMET, Molecular Docking, NSCLC, c-Met.



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DISTRIBUTIONAL PATTERNS OF HOVERFLIES ALONG AN ELEVATIONAL GRADIENT IN NORTH-WESTERN HIMALAYAS, INDIA

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ABSTRACT

Hoverflies play a key role in plant pollination at higher altitudes. With increasing concerns about the decline of potential pollinator populations, a 'sampling monitoring scheme' needs to be developed for the evaluation of the changes in the populations of these key high-altitude pollinators. We sampled hoverfly communities along an altitudinal gradient (1,800-2,800 m.a.s.l.) in a Himalayan mountainous region of India. Yellow pan traps were established at five sampling spots, with 200m difference in altitude between each point. A total of 42 species of hoverflies were collected during one sampling year. Hoverfly populations showed a pronounced change along the increasing altitude with a unimodal distributional pattern of species richness and abundance being observed with a peak at middle altitude (2200 m). The present study poses important conservational consequences. During this study some rare species, and new country records were observed; this study represents important baseline data that would be of immense value in planing a 'sampling monitoring scheme' aimed at assessing the effects of climate change on pollinator populations in these fragile Himalayan habitats.

Keywords: Flower Flies, Kashmir Himalayas, Pollination, Conservation.



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A NEW WAY OF ENHANCING VISIBLE LIGHT ACTIVITY OF TiO_2 FOR THE TREATMENT OF DYES IN WASTEWATER

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ABSTRACT

Environmental concerns have piqued people's interest in recent decades due to their enormous influence on human existence. Because of their significant carcinogenic and mutagenic effects, dyes in wastewater can create major difficulties for humans and other creatures. Photocatalysis has evolved as an alternative dye wastewater treatment method in recent years because of its nontoxicity, excellent selectivity, and long-term stability. The semiconductor TiO_2 used as a photocatalyst and its visible light activity appears to be improved by forming a heterojunction with other narrow band gap semiconductors. Because of the close interfacial connection and adequate conduction and valence band levels, g- C_3N_4 may form a heterojunction with TiO_2 that inhibits recombination of photogenerated electron-hole pairs and considerably enhance photocatalytic activity of TiO_2 under visible light. The microstructure and interface properties of the g- $\text{C}_3\text{N}_4/\text{TiO}_2$ composite are investigated using XRD, SEM, HRTEM, FTIR, and UV-vis DRS. The g- $\text{C}_3\text{N}_4/\text{TiO}_2$ hybrid photocatalysts demonstrated stable photocatalytic activity, indicating that it is a viable material for dye photodegradation in wastewater.

Keywords: Graphitic Carbon Nitride, Titanium Dioxide, g- C_3N_4 - TiO_2 Composit.



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EFFECT OF SR, F CODOPING ON STRUCTURAL AND DIELECTRIC PROPERTIES OF PZT-BASED CERAMICS

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ABSTRACT

PZT ceramics of general formulation $Pb(Zr_xTi_{1-x})O_3$ are widely used in many technological fields due to their dielectric and electromechanical properties. It is possible to modulate these properties and obtain specific characteristics for precise applications by performing cationic and/or anionic substitutions in the crystalline network of the PZT base material of the perovskite structure. $Pb_{1-x}Sr_x(Zr_{0.52}Ti_{0.43}Al_{0.025}Sb_{0.025})O_{3-2x}F_{2x}$ ceramics were fabricated by conventional solid-state reaction. The effect of Ba, F co-doping on structure and dielectric properties of PZT ceramics were studied. The results show that the $Pb_{1-x}Sr_x(Zr_{0.52}Ti_{0.43}Al_{0.025}Sb_{0.025})O_{3-2x}F_{2x}$ ceramics possess Rhombohedral and tetragonal phases for all samples which indicating that we are near the morphotropic phase boundary. The nature of the phases obtained was verified by powder X-Ray Diffraction (PXRD). Cold-pressed pellets of 13 mm diameter and about 1 mm thickness were elaborated by compacting the calcined powders then sintered at temperatures between 1150 and 1270 °C. Depending upon the sintering temperature, the density of ceramics has been changed. The texture (porosity and grain size) of the sintered material was observed by Scanning Electron Microscopy (SEM). The room temperature transmittance of $Pb_{1-x}Sr_x(Zr_{0.52}Ti_{0.43}Al_{0.025}Sb_{0.025})O_{3-2x}F_{2x}$ has been investigated by Fourier Transform Infrared Spectroscopy (FTIR) in the range of 400–4000 cm^{-1} .

Keywords: PZT, Dielectric Properties, SEM.



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**INFLUENCE OF SR AND F CO-DOPING ON THE STRUCTURAL,
MORPHOLOGICAL AND DIELECTRIC PROPERTIES OF PZT CERAMICS**

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ABSTRACT

In this study, solid-state synthesis was used to create the SrCO₃ modified Lead Zirconate Titanate ceramic with Zr/Ti = 43/52 near the morphotropic phase boundary (MPB), whose chemical formula is Pb_{1-x}Sr_x (Zr_{0.43}Ti_{0.52}) (Al_{0.5}Sb_{0.5})_{0.05}O₃. Tetragonal and Rhombohedral symmetry phases coexisted in the system, according to the powder x-ray diffraction (PXRD) analysis of phase formation. A microstructural analysis using a scanning electron microscope (SEM) revealed a non-uniform distribution of large grains over the sample surface as well as the presence of a few micro-sized pores. We studied frequency and temperature dependencies of impedance and electric modulus in a wide frequency range (0.1kHz-1MHz) at different measuring temperatures (300-700K). The results showed the contributions of grains to the material's capacitive and resistive properties. As seen from the Nyquist graph, grains contribute to the resistance and capacitance of the complex impedance plots. The Nyquist plot was applied to an electrical circuit that was equivalent. At all temperatures, precise fitting steps were used to determine the grain resistance and capacitance values. It is assumed that the substitution of Sr²⁺ ions at the Pb-site causes an increase in the dielectric constant at higher temperatures.

Keywords: Perovskite, PXRD, SEM, Impedance..



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IMAGE RECOGNITION IN AN UNCONTROLLED ENVIRONMENT USING ARTIFICIAL NEURAL NETWORK AND CONVOLUTIONAL NEURAL NETWORK

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ABSTRACT

Artificial Intelligence has become increasingly effective in image recognition. Image recognition is a digital image or video technique that identifies and detects an object. However, images taken in an uncontrolled environment are often of low quality, which can lead to misclassification of such images, this study focuses on building an image recognition model that can reliably classify images independent of image quality. To achieve this, Python programming language was adopted in building a Convolutional Neural Network (CNN) and Artificial Neural Network (ANN) models based on TensorFlow, a robust Deep Learning framework, and Keras, a high-level, user friendly API that facilitates the development of the Deep Neural Networks. The CIFAR-10 dataset was adopted for this study and the model recognition with CNN yielded an accuracy of 79% which is a significant improvement over ANN with 50% accuracy. The study therefore concludes that CNN is best for image classification in an uncontrolled environment and due to the fact that max pooling while reducing the dimensions of images but preserving the features, computation complexity in CNN is far less compared to ANN.

Keywords: Deep Learning, Convolutional Neural Networks, Artificial Neural Networks, Uncontrolled Environment.



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**MATERIALS INFORMATICS USING MACHINE LEARNING/DATA SCIENCE:
PROSPECTS AND LIMITATIONS FOR THE AFRICAN SOCIETY**

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ABSTRACT

Materials informatics (MI) is a branch of materials science that utilizes high-throughput computation to analyze large databases of materials properties to gain unique insights for device application. Application of machine learning (ML), artificial intelligence (AI) and Data science are now a common place in materials research. Materials scientists are constantly striving to advance their ability to understand, predict, and improve materials properties. Due to the high cost of traditional trial-and-error methods in materials research, material scientists have increasingly relied on data analysis, simulation and modeling to understand and predict materials properties a priori. This study investigates the prospects and challenges of materials science research in Africa and the role of machine learning and computational materials science towards the development of the materials research focus of Africa. To achieve this, the study reviewed the concept and challenges of materials science research in Africa, materials informatics alongside its prospects and challenges through the use of secondary data from relevant literatures, lecture notes and research experience, reports and involvement. This background is of essence to African researchers given the absence/inadequacy of research funding for consumables, equipment and laboratories in Africa, hence when equipped with sufficient computational resources, African materials scientist will have good opportunity to compete with the leading groups in the world and contribute to the development of science in the region. This study provides valuable reference in science, engineering and technology education employed in training and development programs towards advancing materials science research in Africa.

Keywords: Materials Science, Machine Learning, Data Science, Africa.



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DESIGN AND DEVELOPMENT OF LABORATORY SCALE PENCIL LEADS EXTRUSION DIE

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ABSTRACT

Nigeria is blessed with abundant graphite deposits and raw materials for Pencil production but unfortunately has not been able to harness these potentials for its production. This work is aimed at Designing and developing a laboratory scale Pencil Lead Extrusion Die. The Die was designed using Solid-works e-drawing software version 2013 and developed. It was designed with four different components that can be easily assembled together this include; Die-jig, Die-tube, Rammer and Die-nozzle. HB and 6H grades Pencil Leads of 3mm diameter each were produced using the die with a local graphite concentrate. The produced Pencil Leads were heat treated in a Furnace to impart the desired strength. Local Pencil Stock treated with wax to improve it machining and sharpening characteristics was used. Micro-Hardness test was carried out on both the pencil Lead and the stock using Vickers Micro Hardness Tester. The hardness values of the produced HB and 6H grade Pencils were found to be 35.9HV and 46.8HV which are in agreement with 31.2HV and 42.5HV for standard HB



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and 6H grades respectively. Kapok local Pencil stock was used successfully as a Pencil case due to its good machining and sharpening characteristics with straight and well aligned grains; it also sharpens without splinters. Writability and glide test established that the Pencil glides smoothly with good writability compared with standard HB Pencil Leads.

Keywords: Extrusion Die, Pencil Leads, Graphite Concentrate, Stock.



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**KINETIC MODELING OF POWDER-PACK BORONIZING FOR 4CR5MOSIV1
STEEL USING DIMENSIONAL ANALYSIS**

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ABSTRACT

The main objective of this study is to develop a model for predicting the kinetics of powder-pack boronizing of 4Cr5MoSiV1 steel in the temperature range of 1133 to 1253 K, with treatment durations ranging from 1 to 8 hours. The focus lies on accurately estimating the thicknesses of the resulting boride layers. The proposed kinetic model employs dimensional analysis to simulate the boronizing process for 4Cr5MoSiV1 steel. Subsequently, the experimentally obtained layers' thicknesses are compared to the predicted values. Furthermore, the study demonstrates the effective use of dimensional analysis in the boride layers' thicknesses under the specified boriding parameters.

Keywords: Boriding, Iron Borides, Kinetics, Dimensional Analysis, Modelling.



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MATRIMONY THROUGH TIME: EXPLORING MARRIAGE CUSTOMS AND RITUALS ACROSS DIVERSE ANCIENT CIVILIZATIONS

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ABSTRACT

In this comparative research, the marriage-related practices of Sumerian, Babylonian, Persian, Egyptian, Greek, Roman, Chinese, European, African, and American cultures are examined in relation to one another. The study looks at how marriage has contributed to and maintained social order, as well as the gender roles it practices and the historical and cultural settings that have created them. It indicates that although many cultures regarded marriage as a sacred institution, the specific customs and rites varied greatly. The analysis of secondary sources, academic analysis, and thematic analysis of marriage customs in the chosen civilizations are all used in this study's qualitative methodology. While arranged marriages were common in Sumerian and Babylonian cultures, Greek and Roman society placed a great value on things like dowries and divorce rules. The study also highlights how variable gender roles and expectations are in marriage, with some cultures valuing marriages with more equal partners while others place greater emphasis on the submissive position of women. This study underscores the importance of understanding earlier cultural practices to better understand the origins of our current society and gives insight on the nuanced and various views that ancient civilizations had on the institution of marriage.

Keywords: Marriage, Civilizations, Customs, America, Roman.



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CASE METHOD: TIGHTENING SECURITY TO ENSURE INTEGRITY

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ABSTRACT

Case method is a type of learning where a real-life situation or a situation that resembles real-life presented to learners who attempt to create a solution to the situation. A common scenario at workplace especially in marketing and sale department is for workers to take advantage of the customers by providing false information such as the benefits of a product and its price in order to increase their sales. In light of such case, it is necessary for coworkers who notice this type of misconduct to take proactive actions to prevent this scenario. This team presented a solution where closed-circuit television (CCTV) cameras are installed in designated areas to deter workers from committing anything that violates work ethics. The team decided a vote should be done where the workers in the company should be able to choose either for the offender to stay or be laid off. Preventative measures must also be taken by the company in order to prevent such case from occurring in the future. This includes regular meetings and meeting out fines on those that break rules.

Keywords: Integrity, CCTV, Case Method.



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**A PROPOSAL FOR INVESTIGATION OF PHOTONIC CRYSTAL BILOSENSORS
BY USING ARTIFICIAL NEURAL NETWORKS**

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ABSTRACT

One of the most important applications of photonic crystal is biosensor. The present research proposes slab silicon based on two-dimensional (2D) photonic crystal biosensor. In this paper, machine learning techniques are used to compute optical properties including quality factor and sensitivity for the proposed structure. These machine learning algorithms, based on an artificial neural network, can be able to make accurate predictions of above-mentioned optical properties for parameter including radius of 0.3-0.6 μm , pitch of 1-3 μm , and number of holes 16. The simulation software is Lumerical Mode to investigate the quality factor and sensitivity of the proposed biosensor.

Keywords: Photonic Crystal Biosensor, Machine Learning Algorithm, Neural Network, Sensitivity, Quality Factor.



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**FREE VIBRATION ANALYSIS OF CIRCULAR SANDWICH PLATES
REINFORCED BY FUNCTIONALLY GRADED NANO-GRAPHENE MATERIALS
USING 3D FINITE ELEMENT METHOD**

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ABSTRACT

High strength-to-weight ratio and good energy absorbing of composite sandwich plates have been caused that they are widely used in various engineering applications such as building structures and aerospace. Graphene Nano sheets/Epoxy Nano-composite is used as face sheets of sandwich structures to enhance these applicable structures and increase their strength and stiffness. In this research, free vibration of annular sandwich plates with functionally graded grapheme Nano-composite face sheets is studied. ANSYS standard code is used for three-dimensional finite element method constructing and analyzing of the sandwich plates with a flexible soft core and two functionally graded grapheme Nano-composite face sheets. Natural frequencies of the annular sandwich plates are presented and the effects of geometrical parameters, materials properties and boundary conditions of the sandwich plate are inspected. Comparison of the present results in special case for vibration with those of the accurate annular plate theories confirms the accuracy of the proposed finite element model. According to the obtained results, the natural frequencies of the annular sandwich plate with different boundary conditions are improved by employing the functionally graded grapheme Nano-composite face sheets. Results show that the natural frequencies increase with increase in thickness ratio and radius ratio. Also, obtained results indicated that the boundary conditions affect on behavior of sandwich plates, significantly and plates with clamped boundary conditions have the largest natural frequencies.

Keywords: Finite Element Method, Natural Frequencies, Graphene, Annular Sandwich Plate, Nano-Composite, Functionally Graded Material.



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AIR QUALITY MONITORING: MEASUREMENT OF PM_{2.5} AND PM₁₀ FINE PARTICLES USING SENSOR TECHNOLOGY

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ABSTRACT

Air pollution poses a significant public health concern, often impacting specific population groups on a recurring basis. Over the past few decades, research has established a correlation between environmental degradation and human health, particularly in relation to the presence of pollutants in the air. To illustrate this, we conducted a study in which we measured the levels of fine particulate matter, specifically PM_{2.5} and PM₁₀, using the SDS011 pollution sensor. This sensor proved highly accurate in providing real-time measurements in the Sonatrach GPLI region. However, it did not provide us with information regarding the composition and emission rates of toxic gases regularly released by the nearby refineries. Consequently, we require additional sensor types capable of effectively monitoring these hazardous pollutants.

Keywords: Air Pollution, Air Quality, ARDUINO UNO, Concentration, Human Health, PM_{2.5}; PM₁₀, Sensor SDS011.



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**INTERACTION BETWEEN THE TURBULENT NATURAL CONVECTION OF
NANOFLUIDS AND EXTERNAL MAGNETIC FIELDS IN A RECTANGULAR
CAVITY**

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ABSTRACT

The problem related to the behavior of a conductive liquid in the presence of a magnetic field and a temperature gradient is raised in several areas of industry. In this work, we numerically studied the magnetohydrodynamics of the turbulent natural convection of nanofluids (Water + Ag / TiO₂ / Cu) in a differentially heated rectangular cavity. To predict the turbulent behavior of the flow, we used the standard $\kappa - \varepsilon$ turbulence model. The governing equations of the physical problem are discretized by the finite volume method using the power law interpolation scheme to approximate the values of the functions of the various variables at the interfaces of the control volumes with respect to the nodes of the grid. The study focuses on the effect of physical parameters such as the Rayleigh number ($10^7 \leq Ra \leq 10^{10}$), the two-dimensional orientation of the magnetic field ($0 \leq \gamma < 2\pi$), the Hartmann number ($0 \leq Ha \leq 300$) and the volume fraction in nanoparticles ($0\% \leq \varphi \leq 6\%$). The results obtained show that the Rayleigh and Hartmann numbers have a considerable effect on the hydrodynamic and thermal fields. Indeed, the addition of the nanoparticles changes the thermal and electrical performance of the mixture, which significantly affects the convective heat exchange within the enclosure in the presence of a magnetic field. In addition, the orientation angle of this field strongly affects the hydrodynamic and thermal flow in nanofluids.

Keywords: Convection, Natural, Turbulence, Nanofluid, Magnetic Field, Angle of Orientation.



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A COMPARATIVE STUDY BETWEEN SPWM AND SHE-PWM MODULATION TECHNIQUES FOR A SINGLE-PHASE INVERTER

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ABSTRACT

Inverters play a crucial role in the world of renewable energy and batteries. Acting as the bridge between these sources of power and our everyday devices, inverters convert the direct current (DC) produced by renewable energy sources, such as solar panels or wind turbines, into alternating current (AC). Unfortunately, the operation of these converters often leads to the presence of unwanted harmonic distortion caused by the ON and OFF switching of IGBTs or MOSFETs. To address this issue, various modulation schemes are implemented to efficiently control the on-off switching and effectively minimize these undesirable harmonics. When it comes to modulation methods in the field of DC-AC inverters, Sinusoidal Pulse-Width Modulation (SPWM) and Selective Harmonics Elimination Pulse-Width Modulation (SHE-PWM) are widely recognized. The common parameters between two techniques are modulation index and the number of pulses. The evaluation of results obtained from both techniques relies on the criterion of achieving the lowest possible Total Harmonic Distortion (THD). The THD is a measurement of the harmonic distortion presents in a signal and is defined as the ratio of the root mean square of the harmonic content, including the harmonic components. Maintaining a low level of THD in inverters is important in order to maintain the desired operation. This paper presents a comparative analysis of Sinusoidal Pulse-Width Modulation (SPWM) and Selective Harmonics Elimination Pulse-Width Modulation (SHE-PWM) implemented in a Single-Phase Inverter. In order to evaluate and validate the effectiveness of these techniques, simulation results are obtained using the MATLAB-SIMULINK software.

Keywords: Single-Phase Inverter, Sinusoidal Pulse-Width Modulation, Selective Harmonic Elimination Pulse-Width Modulation, SPWM, SHE-PWM.



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EFFECT OF TEMPERATURE ON DAMAGE STAGES OF CPVC

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ABSTRACT

Plastics play an important role in our daily life due to their ease of installation and relatively low production costs. Currently, polymers are materials of great importance in our modern societies. The Chlorinated PVC is one of the main polymers currently used. is obtained by post-chlorination of the PVC. It has been used in a variety of processes and industries for over 30 years. The effect of adding more chlorine to the PVC molecule is to raise the glass transition temperature (T_g) of the base resin from 95 to the 115–135 °C range. The main objective of this study is to characterize the mechanical behavior of chlorinated polyvinyl chloride (CVPC) at different degrees of temperature from -10°C to 90°C based on simple experimental tensile tests. The experimental results obtained allowed us to follow the evolution of the damage and to quantify it. Subsequently, we were able to determine three stages of damage which make it possible to initially predict the initiation of the damage and then the instant of the critical damage and therefore be able to intervene in time for predictive maintenance of the system.

Keywords: CPVC, Temperature, Damage, Tensile Test, Fraction of Life.



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SKIN DISEASE DIAGNOSIS USING MACHINE LEARNING AND INTERNET OF THINGS (IoT)

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ABSTRACT

With the advancement of technology, professionals are constantly seeking novel electronic equipment to aid in the identification of anomalies within the body. The development of information and communication technology in recent years has resulted in the establishment of the Internet of Things (IoT). In the world, skin illnesses are the most prevalent due to inherited and environmental causes. People frequently disregard the early effects of dermatitis. In the current approach, skin diseases are discovered through the biopsy process, which is then examined and treated manually by doctors. We propose a hybrid approach that combines Internet of Things (IoT) and machine learning approaches in order to get beyond this manual scrutiny and deliver promising results quickly. For this type of technique, the input is fed as the image, or histopathological from texture, colour, and eventually form which are extracted and supplied to Convolution Neural Network (CNN). This CNN network aids in diagnosing and classifying the disease. Using machine learning and image processing, this research suggests a way for detecting skin diseases. Once the skin disease is detected, the food products that should be avoided are listed in the application. So that the escalation of the disease could be avoided. The patient's area code must then be input in the appropriate column, and using that information, a list of dermatologists nearby will be displayed. By using this strategy, it is simple and quick for one to locate the right hospital. As a result, it takes less time to search the hospital. Thus, this suggested application may be a simple approach to diagnose the sickness and aid in helping individuals find appropriate solutions to the specific disease.

Keywords: Skin illness, Convolution Neural Network, Internet of Things (IoT) and Machine Learning.



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**AN ONLINE TRICYCLE TICKETING SYSTEM FOR FEDERAL POLYTECHNIC
BIDA**

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ABSTRACT

Customer satisfaction in e-ticketing is a complex phenomenon that is shaped by a wide range of variables including customer technical support, infrastructure, data security and user-friendliness. Understanding these issues is critical for organizations to create e-ticketing systems that initially meet customer needs and generate a high level of satisfaction. The existing tricycle ticketing system for Federal Polytechnic is manual such that booking of tricycles can only be done in designated areas around the school. This system involves time wasting in booking in which a passenger will either have to trek to the areas where tricycles are usually parked with no assurance of getting a tricycle there. The proposed system is to provide an easier method of transportation and an online system in the Federal Polytechnic Bida, as such an E-ticketing system is designed using React Native, an open-source JavaScript framework used to build apps for multiple platforms including iOS, Android, and web applications and MongoDB as its database. With the new system, passengers can check the availability of seats and reserve a seat online. The challenges posed by the manual method are resolved by this new one and allowing users to avoid squabbling over available seats. It is an achievement in our institution to this type of system of tricycle operation.

Keywords: Tricycle Operation, Federal Polytechnic.



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**QSAR, ADME-TOX, MOLECULAR DOCKING AND MOLECULAR DYNAMICS
SIMULATIONS OF NOVEL SELECTIVE GLYCINE TRANSPORTER TYPE 1
INHIBITORS WITH MEMORY-ENHANCING PROPERTIES**

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ABSTRACT

A structural class of forty glycine transporter type 1 (GlyT1) inhibitors, was examined using molecular modeling techniques. The quantitative structure-activity relationships (QSAR)



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technology confirmed that human GlyT1 activity is strongly and significantly affected by constitutional, geometrical, physicochemical and topological descriptors. ADME-Tox in-silico pharmacokinetics revealed that L28 and L30 ligands were predicted as non-toxic inhibitors with a good ADME profile and the highest probability to penetrate the central nervous system (CNS). Molecular docking results indicated that the predicted inhibitors block GlyT1, reacting specifically with Phe319, Phe325, Tyr123, Tyr 124, Arg52, Asp475, Ala117, Ala479, Ile116 and Ile483 amino acids of the dopamine transporter (DAT) membrane protein. These results were qualified and strengthened using molecular dynamics (MD) study, which affirmed that the established intermolecular interactions for (L28, L30–DAT protein) complexes remain perfectly stable along 50 ns of MD simulation time. Therefore, they could be strongly recommended as therapeutics in medicine to improve memory performance.

Keywords: Dopamine Transporter, QSAR, ADME-TOX, Molecular Docking.



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GREEN SYNTHESIS OF SILVER NANOPARTICLES USING SEAWEED AND THEIR ANTIBACTERIAL ACTIVITY

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ABSTRACT

*Using seaweed extracts to reduce silver metal resulted in a more environmentally friendly silver nanoparticle synthesis. Three seaweed species from the green, brown, and red classes were chosen. The analyses revealed that seaweeds have potential in terms of the presence of functional moiety involved in bio reduction and the stability of silver nanoparticles (AgNPs). The absorption peaks of these nanoparticles in the 400-450 nm range were measured using a UV-Visible spectrophotometer. After the incubation period, the colour intensity increased, and the incubation period for making silver nanoparticles with brown and red seaweeds was 48 hours, whereas the incubation period for green seaweeds was 98 hours. Scanning electron microscopy (SEM) and the Fourier transform infrared (FTIR) technique were used for additional analysis. Silver nanoconjugates were used in antibacterial research. Which demonstrated good antibacterial activity against *S. aureus* and *E. coli*, two bacteria that can cause food poisoning. This synthesis contained no harmful processes, which is good for the environment. The silver nanoconjugates have the potential to be used in drug development, medical devices, water purification, microbial activity, and agriculture.*

Keywords: AgNPs, UV-Visible Spectrophotometer, Fourier Transform Infrared (FTIR), Scanning Electron Microscopy (SEM), Silver Nanoconjugates.



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**EFFECT OF FILM THICKNESS ON THE STRUCTURAL PROPERTIES OF
FERROELECTRIC $\text{Bi}_2\text{FeCrO}_6$ PEROVSKITE THIN FILMS**

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ABSTRACT

$\text{Bi}_2\text{FeCrO}_6$ thin films were grown on Nb-doped $\text{SrTiO}_3(001)$ by pulsed laser deposition with thicknesses of 7.5, 49, 98 nm. X-ray diffraction measurements demonstrate that the deposited films are epitaxial with a preferential growth orientation perpendicular to the (003) plane. The Williamson-Hall equation indicates that microstrain decreases while the crystalline size increases with increasing film thickness, i.e. the increase in relaxation. The UV-Visible measurements were carried out at room temperature.

Keywords: $\text{Bi}_2\text{FeCrO}_6$, Structural Properties, Double Perovskite.



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DIELECTRIC PROPERTIES OF RARE-EARTH DOPED TiO₂

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ABSTRACT

The structural and dielectric properties of TiO₂ samples doped with rare-earth have been synthesized using solid-state method. The XRD data, all of the samples have a tetragonal anatase structure, no change in crystal structure of TiO₂ after doping with different rare-earth concentration, which indicates the single-phase polycrystalline material. The dielectric properties were obtained and associated with the rare-earth content. The a.c. analysis shows that the dielectric constant ϵ and dielectric loss $\tan \delta$ decrease with the increase in Temperature. The dielectric properties decrease with the rare-earth concentration. This behavior has been explained on the basis of Maxwell–Wagner interfacial model.

Keywords: Dielectric Properties, Rare-earth, TiO₂.



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THREE-DIMENSIONAL LATTICE BOLTZMANN STUDY

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ABSTRACT

Lattice Boltzmann Method is a dynamic method that simulates the macroscopic behavior of fluids by using a simple mesoscopic model. It inherited the main principles of Lattice Gas Automaton (LGA) and made improvements. From lattice gas automaton, it is possible to derive the macroscopic Navier-Stokes equations. Lattice Boltzmann Method (LBM). Three-dimensional is proposed for the first time for fluid flow and heat transfer simulation. Three types of cubic natural convection problems are solved with proposed method at various Rayleigh numbers.

Keywords: Cubic Cavity Natural Convection, Lattice Boltzmann Method.



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**LABORATORY EVALUATION AND PARAMETERS OPTIMIZATION OF
HYDRAULIC RAM PUMP USING LOCALLY SOURCED MATERIALS**

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ABSTRACT

The hydraulic ram pump is a mechanism that can raise water to higher levels without requiring external energy input. An evaluation was performed on a hydraulic ram pump in order to confirm and assess the variables that boost its effectiveness. The pump was constructed using materials that were easily obtainable in the region, and the analysis was conducted in Ahmadu Bello University's Hydraulics laboratory of the Department of Water Resources and Environmental Engineering in Zaria, Nigeria. The investigation demonstrated that for a ½" delivery pipe and ¾" supply pipe, the Head of the supply tank 1.93m produced a flow rate at supply tank 33.13L/min, whereas, for a 3.5m Head of the delivery tank, the



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Delivery flow rate was 4.09L/min with a pump efficiency of 22.38%. The ideal setting was determined to be the waste valve located at the end of the tube, with peak and minimum efficiency values of 24.13 and 17.03 respectively, and R^2 values of 0.69 (delivery valve) and 0.97 (waste valve). The study outcomes indicated an inverse correlation between the Head of the delivery tank and the Delivery flow rate at the storage tank outlet and that smaller diameter pipes for delivery in combination with larger diameter supply pipes resulted in higher Delivery flow rate values.

Keywords: Laboratory Evaluation, Hydraulic Ram Pump.



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**EFFECTS OF FIRE OUTBREAKS IN ECOSYSTEMS ON HABITATS AND
DISTRIBUTION PATTERNS OF TERRESTRIAL MAMMALS IN IRAN**

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ABSTRACT

Natural fire regimes help maintain healthy ecosystems, though anthropogenic climate change and land-use change has altered wildfire patterns worldwide, posing a threat to biodiversity. Fire outbreaks in ecosystems can directly or indirectly affect the quality and extent of desirable habitats for species, population size, species distribution patterns, disease outbreaks, and mortality rate of species. The magnitude of this effect highly depends on the biological and ecological characteristics of species as well as the spatial and temporal scales of fires. Thus, management plans should include information about identifying fire-susceptible habitats and post-fire habitat changes. Species distribution models (SDMs) are among the methods that can be employed to provide some of the information above, including predicting critical habitats, connectivity, and landscape susceptibility. Consequently, the present research (a review article) explores the studies conducted on the impact of human-caused fires, and anthropogenic climate change on the distribution patterns of terrestrial mammal species. and changes in their habitats using modeling techniques. According to the findings, scant research has been performed in Iran on the effects of fires as one of the main drivers of species distribution, especially terrestrial mammals. Relevant studies have mainly focused on the impacts of fires on forest vegetation cover. while, fire outbreaks in fire-prone ecosystems cause changes in species distribution patterns, whose consequences include the reduced efficiency of conservation network. Therefore, further research is required to be carried out on the effects of habitat fires on the distribution patterns of mammal species and to identify fire-prone habitats in Iran.

Keywords: Mammal Species, Fire Risk Mapping, Conservation Network, Habitat Modeling, Fire Ecology..



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**APPLICATION OF PROLINE AS PRE-SOWING SEED TREATMENT ON OKRA
UNDER WATER DEFICIT CONDITIONS**

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ABSTRACT

Okra (Abelmoschus esculentus L.) is a flowering plant belongs to Malvaceae family and it is one of the most well-known and frequently used species. A pot experiment was carried out at Old Botanical Garden, University of Agriculture, Faisalabad, to examine the effect of proline as pre-sowing seed treatment on okra. In the Pots, two okra (Abelmoschus esculentus L.) varieties i.e. Sabzpari and Roshni were used for sowing. There were 3 replicates of each treatment. Five kg soil was used in each pot. Okra seeds were pre-soaked in three levels of proline i.e. H₂O, 10 and 20 mM for 12 h to investigate the effect of proline. Two levels of drought (normal watering as control and 60% Field Capacity) were maintained. Experimental layout was completely randomized design (CRD). After 15 days maintaining of drought growth and biochemical related attributes were studied. Results indicated that morphological parameters (shoot length, plant length, shoot fresh and dry weight, root fresh and dry weight, plant fresh and dry weight) were decreased under drought stress. Proline implementation overcame drought effects by increasing these morphological parameters. Antioxidant activities i.e. catalase (CAT), superoxide dismutase (SOD) and peroxidase (POD) also enhanced under drought by the implementation of proline. While reactive oxygen species malondialdehyde (MDA) and hydrogen peroxide (H₂O₂) contents decreased by the application of proline. Mineral shoot ions (Na⁺, K⁺, Ca²⁺) showed positive role in okra plant by the application of proline. Roshni showed better performance than Sabzpari. Best response was recorded at 20 mM proline level.

Keywords: Proline, Okra, Treatment.



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**ASSESSMENT OF FLOOD SPREADING IMPACT ON GROUNDWATER QUALITY
AND GROUNDWATER LEVEL VARIATION USING GEOSPATIAL AND ERS
TECHNIQUE**

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ABSTRACT

This study was carried out in the vulnerable and arid climatic regions of the study area, namely Hala Tehsil of Matiari, Sindh, which has experienced unpredictable droughts and extreme floods in recent decades. Thus, this study focuses to on explaining and visualizing variations in groundwater recharge and groundwater quality along an ephemeral stream that has been modified by flood spreading via an electrical resistivity survey (ERS) and GIS 10.8 of the research area. The ERS was conducted using the ABEM Terrameter SAS 1000 at 16 locations. ABEM Terrameter SAS 1000 has been used to record vertical electric prospecting using a Schlumberger array. The two outer electrodes A and B are used for the current, and the resulting potential difference is measured across the two inner electrodes M and N. The distance of the current and potential electrodes from the center, which are referred to as AB/2 and MN/2, respectively, characterizes the array. MN/2 is always kept sufficiently small relative to AB/2. The results showed the overall dominant quality of regional groundwater up to 60 m deep as 25% fresh, 50% marginal fresh, and the rest as saline water. On the other hand, the water quality of groundwater from 120 m to the depth of 300 m was found to range from marginal water to high salt water. The quantity of good-quality groundwater has also been estimated with ArcGIS interpolation techniques. In addition, groundwater samples were also collected from 16 deep wells located at different distances, and groundwater quality was



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followed via Total Dissolved Solids (TDS), Electrical Conductivity (EC), and pH measurements. The results show a significant impact of flood spreading on the groundwater table and groundwater salinity variation. The groundwater table decreased in all study wells.

Keywords: Electrical Resistivity Survey, Groundwater, GIS, Flood Modelling.



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**COMPARATIVE STUDY BETWEEN FUZZY CONTROLLER AND ANFIS
CONTROLLER FOR QUADRUPLE TANK SYSTEM**

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ABSTRACT

The quadruple tank process has been widely used in control literature to illustrate many concepts in multivariable control. In this context, this paper deals with the intelligent control of a quadruple tank process. The objective of the current study is to design and to compare between fuzzy controller and adaptive neuro fuzzy inference system (ANFIS) controller for a multivariable four-tank process. Simulation results confirm the effectiveness of the proposed control strategies and highlight the superiority of the ANFIS controller in both minimum phase and non-minimum phase operating conditions.

Keywords: Fuzzy Controller, ANFIS Controller, Quadruple Tank System, Non-minimum Phase System.



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**FUZZY LOGIC CONTROLLER OPTIMIZED BY BBO FOR
DECENTRALIZED SOURCE BASED ON A SOFC**

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ABSTRACT

This paper will investigate the efficiency of an optimal fuzzy logic controller (FLC) for a decentralized source which is established on the basis of a solid oxide fuel cell (SOFC) that is linked to the electrical network through a voltage inverter and a boost converter. To serve the purpose of this research, a Biogeography Based Optimization (BBO) is applied in order to adjust the parameters of the membership functions (the centers and the widths of the gaussian membership functions in inputs and output) for the purpose of improving the efficacy of traditional fuzzy logic controller. The given control methods have proved to be effective drawing from simulation results, and show that fuzzy logic controller tuned by biogeography based optimization is better and more robust than the traditional fuzzy logic controller for decentralized source based on a SOFC.

Keywords: Solid Oxide Fuel Cells, Biogeography Based Optimization, Fuzzy Logic Controller.



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RENEWABLE ENERGY

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ABSTRACT

In this paper I will show the types of renewable energy (green energy). It will show the history and statistics of these energies at the service of consumers in Albania. The methodology used is that of the analysis of data from INSTAT Albania as well as state institutions for renewable resources and the ratio of clean to impure energy. In this paper I will demonstrate the calculation of energy productivity. After theoretically describing the production of hydro energy, solar energy and wind energy, I will finish the work in an example mock-up where these energies are included. For the construction of the sample carpet, the laws of physics will help me and the materials used will be recyclable materials at no cost. At the end of the paper, it will show the sources of renewable energy still unused in Albania. This will be a project that will continue to improve and automate the distribution of these energies to the consumer.

Keywords: Renewable Energy, Hydro Energy, Solar Energy, Wind Energy, Energy Productivity.



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TRAVEL TOURISM AND TOURISM INDUSTRY IN INDONESIA

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ABSTRACT

This research intends to explain the study of travel tourism and tourism industry in Indonesia. The research method uses a type of qualitative research with an analytic descriptive approach. This study concluded that tourism is currently an important industrial sector for a country because tourism also contributes to improving a country's economy. After all, it is one of the sources that contribute to income for the country including Indonesia. Indonesia has a variety of tourism potentials spread across various regions and each has its advantages so that the tourism business or industry is becoming increasingly diverse according to the needs of tourist places in general, such as souvenirs, lodging, places to eat, and transportation. Tourism is a service activity that utilizes natural resources and a unique environment, such as cultural products, historical heritage, beautiful natural scenery, and a comfortable climate. A tourist trip is a round trip that takes more than three days, which is carried out alone or arranged by the General Travel Bureau by visiting several cities or places both at home and abroad. Thus, tourism can be said as a trip made for recreation or vacation, and also preparations made for this activity. A tourist or tourist is someone who travels at least eighty kilometers from his home for recreational purposes. In addition, in Islam tourism is always associated with worship, or traveling to remember Allah, such as pilgrimage, hajj, umroh, and so on.

Keywords: Tourism, Travel, Industry, Indonesia.



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SIKH MUSEUMS AS A SOURCE OF IMPARTING KNOWLEDGE TRADITIONS

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ABSTRACT

Historically, collecting, maintaining and studying the artefacts have been the primary functions of museums. However, in last decades more emphasis is being given to exhibitions and imparting knowledge among audience. Due to this, museums have started adopting technology in administration and knowledge sharing. This paper will examine that how Sikh museums are innovative in this regard with the help of following museums: Khalsa Heritage Centre - 'Virasat-e-Khalsa', with its 400-seater auditorium, permanent exhibition spaces, two-storey library, two clusters of slopping galleries along with their striking skyline, Central Sikh Museum, Amritsar displaying antique weapons, manuscripts and portraits to illustrate Sikh history and culture and Baba Baghel Singh Sikh heritage multimedia museum, New Delhi – emphasizing Sikhi principles through artwork, murals, digital screens, multilingual sound. These museums have expanded their horizon beyond the traditional bounds and are proving useful in imparting knowledge. These museums have connected people to people and people to information. As the economic Times have reported that Virasat-E-Khalsa has emerged with most foot traffic, over 5000 tourists visiting daily. Hence these are not merely developing as informational sources but as agents of social and economic transformation. This paper attempts to analyse that how Sikh museums are playing their crucial role in stabilising knowledge and transmitting it to the audience. Various forms of knowledge traditions will also be explored.

Keywords: Sikh Museums, Historically, Traditions.



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CRIME DATA AND INFORMATION MANAGEMENT SYSTEM

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ABSTRACT

This project paper aims to systematise the existing criminal records of the Nigeria police. The essence was to produce robust criminal records and avoidable loss of criminal records. Structural database management system (DBMS) was used in its development in other to remove redundancy in the compilation, its friendliness in responding to the user exhibits and also its reliability and efficiency in tracking down criminals. Another important feature of this Crime Information Management System is that it provides user with the facilities for having the hard copies or print out of any relevant document as well as the facilities to communication with the system. Tracking is the observing of persons or objects on the move and supplying a timely ordered sequence of respective location data to a model e.g. capable to serve for depicting the motion on a display capability. The traditional and age-old system of criminal record and file processing has failed to live up to the requirements of the existing crime scenario. Manual processes neither provide accurate, reliable and comprehensive data round the clock nor does it help in trend prediction and decision support.

Keywords: System, Crime, Management, Database.



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CLIMATE CHANGE, TRAFFICKING, AND PROSTITUTION: EXPLORING INTERLINKED VULNERABILITIES

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ABSTRACT

This research delves into the complex intersection of climate change, human trafficking, and prostitution, uncovering intricate connections between environmental disruptions and exploitative practices. Human trafficking for prostitution, often driven by poverty, takes on new dimensions when viewed through the lens of climate change. This study investigates how climate-induced vulnerabilities propel individuals, especially women, into prostitution as a dire means of survival. The study identifies multifaceted pathways through which climate change indirectly exacerbates human trafficking and prostitution. Climate-related displacement and migration render populations susceptible to trafficking and exploitation. Disrupted local economies, a consequence of climate impacts, force women and children into prostitution for basic sustenance. Depletion of resources due to climate adversity further drives individuals towards trafficking. Climate-related disasters amplify vulnerabilities by damaging infrastructure, making vulnerable communities more receptive to traffickers' influence. The influx of post-disaster temporary labour opportunities creates fertile ground for traffickers to exploit desperation. The research expands the narrative beyond the conventional focus on climate change's environmental consequences. It highlights a shift from legitimate income sources to forced prostitution, revealing that older women, traditionally less vulnerable, are now trafficked, demonstrating the interconnectedness of age, poverty, and exploitation. Climate impacts, coupled with pandemic-induced vulnerabilities, contribute to the exploitation of older women in climate-affected regions like South and North Parganas. The study underscores climate change's broader ramifications, including its impact on women, children, and minority groups vulnerable to trafficking due to climate-induced migration. Examples from Accra, Ghana, underscore the correlation between climate migration and exploitation, necessitating targeted interventions to mitigate vulnerability. Recognising the global nature of climate change's impact, this research advocates for international collaboration. Non-governmental organisations (NGOs) play a pivotal role by bridging the gap between communities and governments to prompt responsive actions, skill-based education, and economic stability in disaster-prone regions. In conclusion, the



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research underscores the need for comprehensive approaches to tackle the interlinked challenges of climate change, trafficking, and prostitution. It emphasises the role of NGOs in advocating for vulnerable communities, promoting gender equality, and fostering sustainable livelihoods. By elevating these concerns to the international stage, governments can be spurred into action, proactively addressing vulnerabilities and safeguarding marginalised populations from exploitation amidst evolving climate dynamics.

Keywords: Climate Change, Trafficking, Prostitution.



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CYBERNETIC HOTEL MANAGEMENT AND RESERVATION SYSTEM

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ABSTRACT

With the growth in the number of web users and necessity for making information available on the web, the problem of web personalization has become very critical and popular, Ambiguity in getting information about hotel, rooms availability and lack comprehensive mechanism for saving guest information for future use are the major setbacks, hence, the need to develop an online reservation system that can offer the speed and convenience of one-stop availability check and confirmation in reservation process. The methodology applied in developing this system is Waterfall paradigm. Fact findings were conducted by visiting web sites of other hotels from internet as well as interview. In conclusion, this automated system is aimed to save time and money for users, thus resulting higher profit to the hotel and better service delivery to its customers.

Keywords: System, Hotel, Booking, Database, Reservation.



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ONLINE NIPOST DELIVERY AND TRACKING SYSTEM

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ABSTRACT

This project paper aimed at developing a software platform that will help a Courier Service Tracking System to determine the current position of vehicles, freight or parcel with a navigation system installed, this facilitates, among other things, efficient allocation of pick-up and delivery of goods, increased equipment utilization, effective maintenance scheduling, improved parcel security, decreased asset losses, and rapid assistance for vehicle in need of help or repair.

Keywords: System, Nipost, Tracking, Database.



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NEWS/EVENTS AUTOMATION SYSTEM

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ABSTRACT

News and event system is a platform developed in order to alleviate the problems faced by numerous organizations that use the notice boards method to pass information. The software tackle problems associated with the use of notice boards which include; information not reaching the target audience in real time, loss of important files, and news or information been tempered with during the process of transmission. The project was conduct so as to develop a software that will be able to take care of all the processes that are involved in automating the notice board method of conveying news and events, this includes; to effectively and efficiently disseminate information about real time news and upcoming events, to provide a reliable source of information, and to bridge the gap between heads of organizations and their staff. The software is designed to carter for the needs of activities document news and events system through the automation of the existing manual system. HTML and XPSS as used to design the GUI, PHP my admin was used to design the database and XAMP server was used to preview the work on browser.

Keywords: System, News, Event, Database.



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**CHEMICAL ANALYSIS OF THE RIVER OF PRIZREN, THROUGH
INSTRUMENTAL ANALYTICAL METHODS**

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ABSTRACT

This research will provide a more accurate picture of the Lumbardh River's water quality in the study region. Several physico-chemical parameters, such as; temperature, pH, EC, TDS, major ions (Ca^{2+} , Mg^{2+} , Na^+ , K^+ , NH_4^+ , NO_2^- , Cl^- , NO_3^-) were determined. Heavy metals have been analyzed using inductively coupled plasma optical emission spectroscopy (ICP-OES). In the water sampling sites, the concentration of Fe as the most abundant element was: 0.897 to 0.485 mg/L, Zn varies from 0.513 to 0.392 mg/L, Ni from 0.174 to the highest of 0.235 mg/L, Mn 0.141-0.194 mg/L, Pb 0.142-0.254 mg/L, whereas As, Cd, Co, Al and Co, were under limit detection in all of the water samples. Also, in the sediment ones the highest concentration element is Fe, followed by Zn, Mn, Ni and Pb. The highest concentration of Fe is in sample M3. The concentration varies from 0.985 mg/kg to the lowest of 0.698 mg/kg, Zn from 0.913 to 0.565 mg/kg, Mn from the highest of 0.413 to the lowest of 0.186 mg/kg, Ni 0.212 to 0.185 mg/kg, Pb 0.187 mg/kg to 0.143 mg/kg, followed by Cu, Co and Al. Even in the soil samples, iron varies from; 0.652 mg/kg to the highest of 0.989 mg/kg, Zn starts from 0.589 to 0.798 mg/kg, Mn from 0.119 to 0.189 mg/kg, Ni 0.139 to 0.178 mg/kg and Pb 0.163 to 0.189. The concentration of Co was observed in three soil samples from 0.033 to 0.064 mg/kg, whereas, Al is presented from 0.045 to 0.054 mg/kg followed by Cu from 0.049 to 0.098 mg/kg. The study shows that we are dealing with moderate pollution with these elements in the river, but to have a firm conclusion, it is advisable to examine more the zone of study.

Keywords: The Lumbardhi River, Soil, Sediment, Water, Pollution, ICP-OES Technique.



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CONSTRUCTION OF MOBILE PHONE DETECTOR FOR USE IN PHONE PROHIBITED ENVIRONMENT

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ABSTRACT

This research work involves the construction of signal detector which is capable of detecting incoming and outgoing signals from mobile phones. The presence of an activated mobile phone can be detected by this portable size mobile signal detector from a distance of 1m to 1.5m which could be used to prevent the use of mobile phone in prohibited environments where they are not to be use such as examination halls, prisons, conference rooms, classrooms, hospital etc. it is also suitable for detecting the use of mobile phone for spying and unauthorized video transmission. The results obtained shown that the ranges detection between the detector and the active mobile phone are, incoming and outgoing calls is 1m, incoming and outgoing SMS is 1m and the GPRS network has the greater value which is 1.5m. All these tests were carried out when the mobile phones were on active or silent mode and not on flight or switch off mode. The moment the gadget detects radio frequency (RF) transmission signal from an activated mobile phones, the beep alarm will starts sounding and the LED blinks. The alarm and the LED will continue to show its indication until the transmission ceases.

Keywords: Signal Detector, Radio Frequency, Mobile Phone.



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**INFLUENCE OF DIGITALISATION ON CONSTRUCTION PROJECT DELIVERY:
A REVIEW**

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ABSTRACT

The construction industry at large is beginning to take advantage of digital technologies through big data, data analytics, internet of things (IoT), artificial intelligence, machine learning and deep learning to enhance the effectiveness of project delivery. The construction industry in developing countries has been said to be under-digitized with organisations failing to realize the full potential and adoption of digitalisation as a driver for growth and efficiency in the industry. Also, the delay in project delivery, cost inefficiencies, uninformed decision making, poor quality and poor performance in terms of productivity have been characterised as a result of absence of adequate digital expertise and technological adoption within the construction industry. Thus, this study reviewed selected literature on influence of digitalisation on construction project delivery and challenges faced in the Nigeria construction industry, intending to establish the current adoption level, highlights some significant challenges and suggests ways to mitigate the challenges. The review revealed that use of digitalisation in construction project delivery in Nigeria is still very low. With sets of challenges such as legal issues and regulations, cultural issues, lack of awareness, security, higher initial costs, project uniqueness, resistance, robotics, institutional and informational sharing. Thus, the study suggests rigorous awareness, especially among the concerned professionals and stakeholders, establishing digital knowledge, basic skills and training from grassroots, usually from the tertiary institutions and related professional bodies, and enacting government policy that will encourage and enforced the adoption and implementation of digital technology in the Nigeria construction industry.

Keywords: Construction Industry, Digitalisation, Project Delivery, Critical Success Factors, Nigeria.



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NEW BUILDING DESIGNS IN HISTORICAL CITIES: MUSEUM ARCHITECTURE

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ABSTRACT

Many methods can be developed to preserve and conserve historic cities, which must be transferred into the future along with their tangible and intangible cultural heritage. One of the most important steps in preserving cities is to protect their users. Ways to protect users include preserving livelihoods, creating new livelihoods, and maintaining and increasing economic levels. In this context, tourism is one of the most widely used methods of preserving and maintaining historic cities, as outlined in various documents published by ICOMOS. Tourism can serve as a valuable tool for the preservation and continuity of historic districts. In addition, tourism paves the way for the design of new structures within historic towns. There is a need for new structures that can fulfill functions that the existing building stock cannot, and that are appropriate to those functions in their spatial context. Museum and art structures can be realized through the redesign of the existing building stock or through new architectural designs. Research conducted around the world and in Türkiye shows that museum buildings are often designed as symbolic, dominant, minimalist, or plain buildings. Both types of buildings contribute to the spread of tourism and historic urban environments.

Keywords: Architecture, Architectural Design, Historical Cities, New Buildings, New Buildings in Historical Cities, Museum, Museum Architecture.



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CONTEMPORARY BUILDINGS IN RURAL SETTLEMENTS

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ABSTRACT

Traditional houses in rural settlements deteriorate over time. The main reason of deterioration is disrepair. The maintenance of traditional houses that have been disrepaired for a long time becomes more difficult. In this case, constructing a new building appears as a faster and more economical solution than repairing the existing one. People living in rural settlements generally prefer to build new structures. Apartments, which are the components of the urban texture, are increasing in traditional environments, since the design process is not given attention in the new building. Compatible designs with the original texture can be produced by analyzing correctly the existing texture. Contemporary buildings in rural regions of Europe can be considered successful. The level of public awareness and economic income are effective in this situation. The availability of the design service is also an important factor. There are also qualified contemporary buildings in rural areas of Türkiye. For example, the buildings of Nevzat Sayın in Yahşibey are noteworthy. These buildings contain the comfort of urban life, the requirements of rural life and references to the original texture. Attention should be paid to the design process, in order to increase quality of new buildings in Türkiye. It is important to come up with solutions that will make the life of users economically and socially easy.

Keywords: Rural Settlement, New Building, Contemporary Design.



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SEARCHING FOR NATURE IN ARCHITECTURE IN THE HISTORICAL PROCESS AND BIOPHILIC DESIGN

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ABSTRACT

Humanity's ability to dominate nature started with agriculture 12,000 years ago and has continued to develop with the ongoing urbanization activities for 6,000 years. The relationship between the human and the nature, and the forms of interaction, which finds itself in the built environment by separating from nature, are also reflected in the practice of architecture. Although it does not cover a process that was consciously researched and produced in the early ages, every architectural product has been a direct historical indicator of the nature-human relationship. These indicators sometimes differentiate according to how nature is defined, with which philosophy it is handled or what it serves in design, and they become different representations of nature pursuits and form different design approaches based on nature. This scope of work; Art Nouveau, Organic Architecture, Green Architecture, Ecological Architecture, Sustainable Architecture, and Biomimetic architecture approaches have been discussed due to their theorizing on the foundations of the relationship between nature and architecture and taking their place in the history of architecture with this aspect, and similarity with the biophilic design approach, which stands out with the aim of providing nature experience especially in mega cities. and their differences are discussed. With this research, it was aimed to analyze the relationship of humanity with nature on a spatial scale, to discuss the role of nature in the discipline of architecture, and to make predictions about the future of nature in architectural design practice. As a result, it has been revealed that biophilic design has a more inclusive understanding as it mostly includes all the design inputs (form, function, economy and energy) and all of the design approaches led by nature. In this context, biophilic design; With its aspects such as improving human health and well-being, strengthening the sense of belonging to nature and environmental awareness, and helping to protect nature in the long term, it offers great potentials for today's people in search of nature.

Keywords: Biophilic Design, Nature Based Design, Nature-Based Architectural Theories, Nature-Based Architecture.



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EXAMINING PRESCHOOL EDUCATION BUILDINGS WITH SUSTAINABLE ARCHITECTURAL APPROACH: TWO EXAMPLES IN KONYA SELÇUKLU

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ABSTRACT

Today, natural resources are being depleted rapidly due to developing technology and industrialization, environmental pollution and global warming are emerging as the current problems of the world. The fact that a significant proportion of existing structures are built without considering ecological approaches causes unconscious depletion of natural resources. For this reason, besides the construction of new buildings with a sustainable architectural approach, the potentials of existing buildings should be determined and steps towards ecological improvement should be taken. Among the steps taken, educational structures are important. It has been stated in many researches that taking part in an ecologically oriented education environment from an early age, sustainability and environmental awareness contribute significantly to learning by experience. In this context, two kindergartens, one of which is a state and the other is affiliated to a private institution, in Selçuklu district of Konya province were randomly selected. The buildings were examined within the scope of sustainable architecture, while their existing ecological features were evaluated positively, suggestions for ecological renewal were presented through world examples. In the study, a literature review focused on ecology, children and educational buildings was made, and then on-site observation, photographing and in-depth interview techniques were used to determine the appropriate and problematic aspects on the basis of ecological criteria of the sample buildings. In this study, which was prepared with the idea that raising the environmental awareness of the society can be realized with education and children; designing the buildings where preschool children receive education with a sustainable architectural approach; It has been concluded that it plays an important role in the formation of ecological awareness and in gaining livable environmental awareness. The ecological characteristics of both educational policies and physical spaces constitute the infrastructure of environmentally conscious societies.

Keywords: Sustainable Architecture, Preschool Education Buildings, Child, Environmental Awareness.



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THE SEISMIC VULNERABILITY OF HISTORICAL MASONRY BRIDGES: THE CASE STUDY OF FEBRUARY 2023 EARTHQUAKES

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ABSTRACT

Türkiye is located on active fault lines within the Alp-Himalaya Earthquake Belt. As a result of this situation, particularly in recent years, highly destructive earthquakes have occurred. The most recent examples of these devastating earthquakes are the February 2023 earthquakes with magnitudes of 7.8 (MW) and 7.5 (MW) that occurred on the 6th of February, 2023. Thousands of buildings were demolished in these earthquakes in Türkiye. In the buildings that didn't collapse, there are a significant number of heavily and moderately damaged structures. 10 provinces were affected by this earthquake and among the damaged buildings, there were also historical buildings that needed to be conserved. These historical buildings, most of which were built with masonry construction technique, lack "ductile" behaviour, which is important in earthquake behaviour. In the scope of this study, expert reports published after February 2023 and news articles in the media were examined to assess the conditions of historical bridges located in the earthquake zone. Among the historical masonry bridges with significant architectural value that need to be preserved, the following were investigated: Cendere Bridge, Kızılın Bridge, Şeytan/Mamluk Bridge, Vijne Bridge, Ceyhan Bridge, Batıyaz Bridge, Demir Bridge, and Danaahmetli Bridge. As a result of the examinations, it was determined that some of these bridges were completely destroyed, some suffered severe structural damages, some incurred non-structural damages, and some remained undamaged. The aim of this study is to identify what can be done to protect and strengthen these heritage areas located in earthquake-prone regions. The conclusions of the study identify important factors for the earthquake resistance of historical masonry bridges, as well as measures that can be taken before and after earthquakes to minimize damage. The aim is to ensure that these structures sustain minimal damage in the event of a new earthquake by implementing the determined measures.

Keywords: February 2023 Earthquakes, Historical Masonry Bridges, Seismic Vulnerability, Post-disaster Assessment, Türkiye.



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TEMPORARY FOLDABLE CHILDREN'S SOCIALIZATION SPACES AFTER EARTHQUAKE: INTERIOR ARCHITECTURE WORKSHOP EXPERIENCE

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ABSTRACT

Earthquakes in natural disasters; They are disasters that cause deep wounds economically, sociologically and psychologically. The big earthquakes in Kahramanmaraş on February 6, 2023 in our country caused many loss of life and property. Entrepreneurs from all professions play an important role in post-disaster recovery, with innovative solutions and efforts to improve. Among them, the professional discipline of architecture and interior architecture is at the forefront. In this context, it is aimed to raise the awareness of interior architecture students who receive design discipline education about natural disasters, to develop innovative and permanent solution proposals after disasters, and to reveal original designs that raise awareness. Within the scope of the project, it is aimed to develop solutions for the problem of meeting the unfinished education, play and spatial needs of the children most affected by the earthquake in order to overcome their traumatic situations. In this context, Selcuk University, Faculty of Architecture and Design, Department of Interior Architecture, 2022-2023 Spring Semester, Interior Architecture Project-IV course, together with the 3rd grade students, in the workshop on the subject of 'temporary foldable children's socialization spaces after the earthquake' online. has been carried out. Within the scope of the workshop, foldable tent design suggestions were developed, and as the limitations of the shell design; foldable, modular, light and portable, manufacturable, flexible and packable has been defined as a design problem. As the method used in the workshop; A 3-stage systematic method consisting of analytical understanding, creative decision making and application for design-oriented learning was applied. While the analytical phase includes the data collection process, the original form-form generation takes place in the creative phase in the shell and interior design process of the obtained data. At the end of the workshop, the boundaries of the interior architecture students in the search for solutions to the design problem were drawn and creative designs were created in the students' decision of function, form and structure. In addition, in the function solutions for the problem presented, foldability was associated as a keyword as a guide in form decisions, and they developed a working doctrine that could design at different scales from equipment to space design within the method.

Keywords: Temporary Space, Children's Spaces, Collapsible Design, Interior Design Workshop.



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A CHRONOLOGICAL INQUIRY ON THE DESTRUCTIVE EFFECTS OF THE EARTHQUAKES ON URBAN IDENTITY: BURSA CASE

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ABSTRACT

Disasters, especially seismic disasters, play a critical role in shaping the earth. Landforms are also determinants in the formation of urban patterns. The pattern of a city is one of the essential parts of that city's daily life practices and identity. Seismic disasters, which form the landforms that make the urban pattern unique, can also devastate this pattern. Numerous major earthquake disasters have been documented since ancient times. As a result of these earthquakes, it is tough to carry many elements that make up the city's identity today. The lack of representation of identity elements in the city damages the collective memory of the city. This study aimed to examine the adverse effects of the destruction caused by earthquakes on the continuity of urban texture and identity. Bursa, the first capital of the Ottoman Empire, which is discussed within the scope of the study, is a leading city in terms of natural riches, history, and industrial identity. In this context, the earthquakes and the changes in the urban pattern and identity after these earthquakes were examined chronologically. The effect of the changing pattern in the city on the urban identity has been reconsidered through the current urban pattern, and suggestions have been developed for preserving the urban identity and texture in case of a possible earthquake in the future. The study outputs will likely be a guide in drawing attention to the destructive effects of disasters on the urban texture and identity and developing strategies in this direction.

Keywords: Earthquakes, Urban Pattern, Urban Identity, Seismic Disasters, Bursa, Türkiye.



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DEVELOPMENT OF DIGITAL TECHNOLOGY AND ARCHITECTURAL DESIGN; A STUDY ON THE REFLECTION OF VIRTUAL REALITY THEMED FILMS AND METAVERSE UNIVERSE INTERACTION ON ARCHITECTURAL DESIGN

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ABSTRACT

With the rapid development of technology in recent years, we see significant changes in many sectors such as architecture. Virtual reality is one of the most prominent of these changes and has now become a part of architectural design and applications. Virtual reality has become particularly important in recent years, both as a result of technological advances and because of its wide acceptance in popular culture. Virtual reality-themed films explore this concept from many different perspectives, often incorporating unique and innovative architectural elements in the process. These films can inspire the design and development of large, virtual reality-based universes called metaverses. Metaverse universes are virtual spaces that are often shared and interacted with by a wide range of users, and they often have a wide variety of aesthetic and design features. In this study, the interaction between prominent architectural elements in some popular movies with a virtual reality theme and the increasingly popular and expanding Metaverse universe will be examined. Also in this study; can make an important contribution to the science of architecture and design by examining in depth the impact of digital technology on the formation and evolution of architectural designs. Understanding how advancing technologies such as virtual reality and metaverse universes affect architectural design processes and outcomes can help architects and designers use technology more effectively and creatively.

Keywords: Virtual Reality, Movie and Architecture, Metaverse Universe, Architectural Design.



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COMPUTER AIDED DRUG DESIGN AND DISCOVERY OF NOVEL ANTICANCER AGENTS

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ABSTRACT

The field of drug discovery has undergone significant advancement with the adoption of rational strategies that leverage the fundamental understanding of protein-ligand interactions. Two prominent approaches, namely, structure-based drug design (SBDD) and ligand-based drug design (LBDD), combine cutting-edge concepts from modern chemistry and biology, effectively merging medicinal chemistry with structural biology. This research presents a novel bioinformatics-guided technique for identifying promising breast cancer drugs. To evaluate the potential of quinoline derivatives as antitumor agents and their applicability in breast cancer treatment, we conducted a comprehensive analysis employing three-dimensional quantitative structure-activity relationships (3D-QSAR) and molecular docking studies with the aromatase enzyme (PDB: 3S7S). By employing Comparative Molecular Similarity Analysis (CoMSIA), we established a robust 3D-QSAR model that exhibited remarkable statistical significance for Q^2 , R^2 and R^2_{pred} , affirming its high reliability. To validate the predictive capability of the model, we conducted an external validation using an independent test set, further confirming its accuracy. The findings of this study highlight the significant impact of electrostatic, hydrophobic, hydrogen bond donor, and acceptor fields on breast cancer activity. Leveraging this knowledge, we designed a series of potent aromatase inhibitors and utilized our best model to predict their inhibitory effects. Finally, the newly proposed drug candidates underwent evaluation based on ADMET properties, ensuring a comprehensive assessment of their potential efficacy and safety profiles.

Keywords: SBDD, LBDD, Cancer, QSAR, Docking, ADMET.



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THE DOUBLE ROLE OF NUTRIENTS IN IMMUNITY

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ABSTRACT

Background Nutrients are the substances found in food which drive biological activity, and are essential for the human body. Several studies have emphasized that some nutrients may increase an individual risk for cancer, while others may be protective. Dietary nutrients may be converted into metabolites by intestinal microbes that serve as biologically active molecules affecting regulatory functions in the host. *Objectives* To demonstrate role of nutrients as functional foods in the management of immunity. *Materials and methods* This includes the role of macronutrients, micronutrients, and the gut microbiome in mediating immunological effects. Nutritional modulation of the immune system has applications within the clinical setting, but can also have a role in healthy populations, acting to reduce or delay the onset of immune-mediated chronic diseases. Ongoing research in this field will ultimately lead to a better understanding of the role of diet and nutrients in immune function. *Results* Probiotics may restore the composition of the gut microbiome and introduce beneficial functions to gut microbial communities, resulting in amelioration or prevention of gut inflammation and other intestinal or systemic disease phenotypes. A well-functioning immune system is critical for survival. The immune system must be constantly alert, monitoring for signs of invasion or danger. Cells of the immune system must be able to distinguish self from non-self and furthermore discriminate between non-self molecules which are harmful (e.g., those from pathogens) and innocuous non-self molecules (e.g., from food). *Conclusion* This presentation describes how diet and intestinal luminal conversion by gut microbes play a role in immune-mediated chronic diseases.

Keywords: Nutrients, Gut Microbiota, Immunomodulation.



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THE USE OF FRACTALS IN CANCER RESEARCH

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ABSTRACT

Fractals, intricate geometric patterns characterized by self-similarity across scales, have found profound applications in the realm of cancer research. This abstract delves into the burgeoning synergy between fractal geometry and oncology, illuminating its potential to unravel complexities in tumor growth, angiogenesis, and disease progression. Fractals provide a novel lens through which to explore the intricate branching patterns of blood vessels within tumors, aiding in the understanding of angiogenesis – a hallmark of cancer development. By quantifying fractal dimensions and analyzing the self-replicating nature of vessels, researchers gain insights into the chaotic yet ordered nature of tumor vasculature, offering opportunities for targeted therapies. Moreover, fractal analysis offers a robust framework for comprehending the irregular morphology of tumors. By examining the self-similar patterns within tumor borders, researchers discern the degree of tumor invasiveness and heterogeneity, crucial factors influencing prognosis and treatment strategies. Fractal dimensions have been linked to prognostic indicators, assisting in risk assessment and personalized treatment plans. In the context of cancer imaging, fractals aid in early detection and diagnosis. The self-similar nature of tumor growth manifests in various medical imaging modalities, enabling the identification of subtle irregularities that might otherwise be overlooked. This contributes to enhanced diagnostic accuracy and improved patient outcomes. This abstract highlights the burgeoning role of fractals in cancer research, elucidating their capacity to decipher intricate tumor characteristics, vascular patterns, and growth dynamics. By leveraging fractal geometry, researchers forge a pathway toward deeper insights into cancer biology, diagnosis, and treatment, fostering a promising interdisciplinary frontier at the crossroads of mathematics and oncology.

Keywords: Cancer Research, Oncology, Fractal Geometry.



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**QUICKLIME PRODUCTION FROM EGGSHELL USING RESPONSE SURFACE
METHODOLOGY**

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ABSTRACT

This study developed empirical response surface models for optimizing the quicklime characteristics. The calcination process parameters evaluated were calcination temperature, calcination time, and eggshell particle size. Two process models were successfully developed and validated for RSM models. The modeling validation runs were within the 95% prediction interval of the developed models and their residual errors compared to the predicted values were less than 5%. Results from this study shows that the significant parameters that influenced the quicklime yield and reactivity are calcination temperature, calcination time and eggshell particle size. The RSM approach shows that a compromised setting of calcination temperature of 945.91°C and calcination time of 180.82 min will produce quicklime of optimal yield of 99.6608 % and optimum level of calcination time of 210 min and calcination temperature of 895.03°C produced optimum quicklime reactivity of 0.467835°C/s. The RSM models developed in this study can be used in the quicklime production industries to find the settings of the calcination process that will maximize quicklime quantity and quality. This will reduce the downtime encountered by industries having problems caused by variation in the quality of purchased quicklime.

Keywords: Calcination Temperature, Calcination Time, Eggshell Particle Size.



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DEVELOPMENT AND PERFORMANCE EVALUATION OF A MILLET DEHULLER

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ABSTRACT

Despite the research and designs carried out by various individual and institutions, poor and rural farmers in largely growing millet producing areas of Sub-Saharan Africa face challenges in accessing the dehuller because of prohibitive cost of the machine due to non availability of the machine locally. A dehuller was developed and evaluated for threshing, separating, and cleaning millet seeds. The major components of the machine include threshing, separation and cleaning units. The component parts were designed using standard equation and formulae. The threshing operation is achieved by rotational motion of a cylinder fitted with beater pegs above a stationary grid. The machine was powered by a 2 hp electric motor. It was tested to thresh, separate and clean the millet seeds. The results showed that the machine had the highest threshing and cleaning efficiencies of 63.2 and 62.7%, respectively, when pearl millet panicles were processed at 13% moisture content and at an 800 rpm threshing cylinder speed. The lowest threshing and cleaning efficiencies of 40.68 and 50%, respectively, were obtained when the pearl millet panicle was processed at 17% moisture content and a 600 rpm threshing cylinder speed, and at 17% moisture content and 700 rpm. Thus, the optimum operating parameters of the machine were 13% moisture content (wet basis) of pearl millet panicles and 800 rpm threshing drum speed. The cost of the machine is estimated as 200 USD. The successful development of this machine is expected to reduce drudgery associated with the traditional method of threshing millet and therefore increase productivity of farmers.

Keywords: Cleaning Efficiency, Design, Fabrication, Threshing Efficiency, Separating.



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STRATEGIES FOR OVERCOMING DIFFICULT SITUATIONS AMONG THE ROMA POPULATION IN ROMANIA

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ABSTRACT

The aim of this paper is to inventory coping strategies as presented by the Roma population in 4 communities in Romania (2 towns and 2 villages). We present in the paper the relevant results of the project "The role of religion and religious actors in Roma social inclusion: towards a participatory approach" PARI – RO-NO-2019-0586. The research carried out is based on a qualitative methodology comprising: (Walking) in-depth interviews with Roma people (heteroidentification and self-identification); Semi-structured interviews with key actors (representatives of the public authorities, social workers, religious leaders, teachers etc.); Observation in communities – fieldwork notes. The research question this paper answers is: what helps Roma in the community to overcome difficult times/situations. The answers to this question were grouped into three categories: support from family ("If I have a problem I turn to my husband" F28 B; "I consult my children" M76 F), support from friends or neighbours ("I'm still talking to my girlfriend" F67 R, : "Maybe I'll call some more friends who know you and chat. You talk to someone to calm down... Yes, but with someone who understands you, not someone who judges you or criticizes you, because you are already upset" F30 B) and faith in God (No one helps me but God ("No one helps me but God " F74 B).

Keywords: Roma, Overcoming Difficult Situations, Strategies.



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ELECTROCATALYTIC SYNTHESIS OF HYDROGEN AND AMMONIA FUELS

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ABSTRACT

Catalytic electrosynthesis has emerged as a highly promising method to synthesize high value-added fuels and chemicals (e.g., ammonia, urea, H₂O₂, carbohydrate, organic molecules), which are commonly synthesized by conventional methods that often involve intensive energy consumption and greenhouse emission. Currently the electrosynthesis of chemical fuels still suffers from large overpotential and thus high energy input due to the sluggish reaction kinetics and poor selectivity. In this report, we will demonstrate how the efficiency of the electrosynthesis can be improved by catalyst and electrolyzer design. Specifically, we will give a few examples on acidic oxygen evolution reaction electrocatalyst design, bipolar hydrogen production by coupling hydrogen evolution reaction and small molecular oxidation reaction, as well as electrolytic systems for simultaneous ammonia and electricity generation.

Keywords: Electrocatalytic Synthesis of Hydrogen, Ammonia Fuels.



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**APPLICATION OF 2.5 MEV PIXE ANALYTICAL TECHNIQUES TO COASTAL
SEDIMENTS: INSIGHTS INTO ELEMENTAL COMPOSITION AND
ENVIRONMENTAL IMPLICATIONS**

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ABSTRACT

Particle Induced X-ray Emission (PIXE) technique is a fast, powerful, multi-elemental and non-destructive analytical tool, dedicated for the analysis of materials especially geological samples. Sediment samples collected from the Lagos port area, southwest Nigeria were analyzed by PIXE technique for their elemental composition and concentrations. The PIXE analysis was carried out using a 1.7 MV Tandem accelerator with energy of 2.5 MeV protons located at the Centre for Energy Research and Training (CERT), ABU, Zaria. Data analysis was performed in an interactive mode with the aid of GUPIXWIN analytical software. Identified elements are present in the fingerprint X-ray spectrum in levels of ppm. In this study, introductory results concerning qualification and quantification of major, minor and trace elements embedded in sediments obtained from the Lagos port area, are presented. Also, insights into the environmental quality of the port area was revealed. Validity of the technique was assessed using standard reference material (SRM) NIST 1646a estuarine sediment, and result was consistent with the certified one. The study uncovered potential anthropogenic influences and the significance of employing PIXE in environmental monitoring and assessments.

Keywords: Lagos Port, Sediments, PIXE Analysis, Elements, Concentrations.



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**ESTIMATION AND PREDICTION OF BIOGAS GENERATION FROM TIZI
OUZOU LANDFILL BY LANDGEM MATHEMATICAL MODEL**

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ABSTRACT

One major contributing factor to greenhouse gas emissions in the environment is the generation of hazardous gases in municipal landfills. Due to the potential negative impacts of this, it is essential to estimate the quantity and type of landfill gases in order to design and establish a gas collection system. Landfill gas emissions are influenced by numerous factors such as the waste type, its biodegradability, its methane emission potential, the degree of separation, and various other miscellaneous factors. In our study, the LandGem model was utilized to predict the amount of gases produced in the landfills of Tizi Ouzou. According to the results, a significant amount of CH₄ was released from 2010 to 2022, contributing to global warming. This energy loss can be harnessed and converted into electricity, thus enabling the landfill to become energy self-sufficient.

Keywords: Solid Waste, Landfill, Energy, Methane, LandGem.



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EFFECT OF *CHIERANTHUS CHIERI* SEEDS ON PANCREATIC PHYSIOLOGY AND BETA-CELL REGENERATION IN ALLOXAN INDUCED DIABETIC RATS

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ABSTRACT

Diabetes is defined as metabolic disease commonly observed in the clinics and is characterized by hyperglycemia due to impaired insulin secretion, insulin resistance, or both, resulting in impaired metabolism of sugars, lipids, and protein. Diabetes's large incidence, diverse pathophysiology, progressive process and consequences all underscore the critical need for improved therapies. To control diabetes, many treatments such as insulin therapy, medication, and food therapy are available. Herbal plants are now used to treat diabetes since they have fewer adverse effects. However, current study was designed to evaluate the effects of Cheiranthus cheiri seeds on glucose level, insulin level, body weight and the



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regeneration of beta cells in alloxan induced diabetic rats. For this purpose, adult albino rats weighing about 180-200g were used and kept at experimental research station of Department of Physiology at Government College University Faisalabad. Following the adaptation period of 7 days, the rats were separated into four groups. The negative group (non-diabetic) rats got a single intraperitoneal injection of normal saline and were fed routine diet. Second group was positive control (untreated diabetic) and received alloxan (150 mg/kg body weight) and standard diet. Third group was standard and received glibenclamide (10 mg/kg body weight) along with alloxan (150 mg/kg body weight) and standard diet. Fourth group was treated diabetic and rats received alloxan (150 mg/kg body weight) as well as ethanolic extract of Cheiranthus cheiri seeds (10 mg/kg body weight). On the 21st day, the blood sample was collected for measuring blood glucose level. Parameters like serum CBC, serum glucose, serum insulin, Oxidative stress markers (TAC, TOS, MDA) were assessed. For histological analysis, samples of pancreatic tissue were collected. One-way ANOVA (Analysis of Variance) and DMR (Duncan's multiple range) were used to statistically analyze the data. Results of current study revealed that Cheiranthus cheiri had significant effects on body weight and normalized the levels of fasting blood glucose, serum glucose, serum insulin in treatment group as compared to positive control group. According to histopathological examination, results indicated that the pancreas of rats in negative control group had fully active islets of Langerhans with normal pancreatic cells. However, in positive control group, pancreas showed destruction of β -cells, small sized islets of Langerhans and loss of cellular contents. The normal histological structure was restored in the Cheiranthus cheiri seeds-treated group, demonstrating that normal pancreatic parenchyma and completely functional β -cells in islets of Langerhans were advantageous for pancreatic beta-cell regeneration. Gene expression levels for INS-1, INS-2, PDX-1, and IGF-1 were observed in the group treated with Cheiranthus cheiri seeds. Additionally, Cheiranthus cheiri seeds enhanced beta cell performance and returned INS-1, INS-2, PDX-1, and IGF-1 expression to normal levels. In conclusion, it was discovered that Cheiranthus cheiri seeds are advantageous for the normal functioning of the pancreas and the regeneration of beta cells.

Keywords: *Cheiranthus Chieri, Diabetic Rats, ANOVA.*



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THE PROBLEM OF TOLERANCE IN HISTORY

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ABSTRACT

In the vocabulary of scientists and ordinary citizens, the word tolerance is increasingly used as one of the necessary conditions for mutual understanding in social life. It is considered as a fundamental sign of culture, which is designed to free the human community from the spirit of hostility, intolerance, hatred and to contribute to the gradual rooting of empathy, benevolence, and respect for another person in society. Tolerance appears as a certain vector of social relations, as a strategy of new sociologization. It is called to solve acute problems of reality in a balanced and impartial manner, to take care of understanding and cooperation in order to preserve the world intact. It acquires a special socio-cultural sound as a factor capable of overcoming confrontation and enmity, contributing to the establishment of co-existence, co-activity of people with different worldviews, acting as an effective way of preserving social balance. Self-discovery through history opens up new horizons of human existence in the vicissitudes of one's own destiny and helps restore the lost system of moral and spiritual coordinates. In this context, the historical heritage acquires a slightly different aspect, devoid of the alienation and ABSTRACTness of historical knowledge, oriented towards the search, formation of worldview landmarks of modern man, his ability to constructively, balanced resolution of social contradictions, readiness to nurture the sprouts of tolerance and mutual understanding in society. A tolerant, balanced, understanding approach to the knowledge of historical phenomena and processes is aimed at the study of a person, his inner spiritual and psychological world, the diversity of social life practices, that is, focused on the growth of the individual and growth through the prism of human society, delineating new horizons of his progress. An essential component of society's development is culture, which is designed to liberate society from hostility, intolerance, and hatred, and to promote the rooting of empathy, benevolence, and respect for the Other, freed from the spirit of hostility, hatred, and intolerance, into the life practices of society.

Keywords: Past, History, Modernity, Tolerance, Values, Spirituality.



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**THERMODYNAMIC AND MAGNETOCALORIC PROPERTIES OF A
GRAPHULLERENE 2D NANOMATERIAL**

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ABSTRACT

The synthesis of graphullerene 2D nanomaterial with unexpected properties represents a groundbreaking achievement in the realm of carbon-based materials, holding promising prospects for the development of a novel category of two-dimensional 2D materials. Herein, we investigated the thermodynamic features and magnetocaloric effect of graphullerene-like structure through Monte Carlo simulations based on standard Metropolis algorithm. In this paper, we detailed the impact of the Hamiltonian parameters on the thermodynamic properties and magnetocaloric quantities of the system. Distinct characteristic behaviors were observed, including first- and second-order phase transitions, Q-type behavior and square hysteresis loops. Furthermore, it has been found that altering the magnetic field not only enables critical temperature regulation, but also significantly affects the magnetocaloric characteristics, including the magnetic entropy change and the relative cooling capacity. Our findings strongly suggest that the graphullerene-like 2D nanomaterial is a promising candidate for magnetic refrigeration applications.

Keywords: Thermodynamic, Magnetocaloric Properties.



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UNVEILING THE THRILLING COASTS: EXPLORING CONTEMPORARY WATERFRONT DESIGN THEORIES

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ABSTRACT

This article explores the intriguing realm of contemporary theories on waterfront architecture, adopting an accurate approach to analyze waterfronts that have been recognized with significant awards. The growing transformation of urban environments has led to heightened recognition of the importance of waterfronts as lively and dynamic public areas, attracting the interest of professionals in fields such as architecture, urban planning, and environmental studies. This study aims to analyze a curated collection of prestigious waterfront projects to clarify the innovative concepts and methodologies underpinning modern waterfront architecture. The study highlights the impact of these theories on urban waterfronts, illustrating their ability to enhance the appeal and engagement of residents and visitors through the effective incorporation of natural components, sustainable practices, and community involvement. Through an examination of these illustrative case examples, this research enhances our comprehension of urban planning and architecture. This study offers significant perspectives on the symbiotic relationship between human activities and the natural environment, promoting a sustainable and appealing future for coastal towns across the globe.

Keywords: Waterfront, Waterfront Design Theories, Symbiotic Relationship.



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SOCIAL SUSTAINABILITY IN PUBLIC INTERIORS: ACCESSIBILITY OF WHEELCHAIR USERS IN THE CASE OF İSTANBUL'S PIERS AND FERRIES

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ABSTRACT

Sustainability includes environmental, economic, social and cultural dimensions. Knowing that these dimensions are inseparable, this study mainly focus on social sustainability considering socio-spatial equity in public interiors. Reducing inequalities, increasing inclusion in public interiors make use of these spaces equal for everyone. Wheelchair users, compared to others who do not have any physical restrictions, are blocked for many reasons in different areas. One of these areas is accessibility of public spaces. Wheelchair users cannot experience the city they live in equally. In an ideal city, every urbanite should be able to benefit equally from all public spaces and services. In this context, achieving equality in every place and in every condition is possible to a large extent with design. For all situations, the availability of design by all users, turns it into a design for everyone. Considering these, in this study a research has been carried out on the interiors of piers and ferries of İstanbul. The study was conducted on a physical activity scenario based on the ability of a wheelchair user to travel independently without the assistance of another person in the piers and on the ferries running between them. The importance of these piers is that they have been preserved with some transformations and used since 19th century and therefore be involved in cultural dimension of sustainability.

Keywords: Accessibility, Inclusive Design, Interior Design, Social Sustainability, Cultural Sustainability.



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**CASE STUDY OF AN INDUSTRIAL HALL ASSESSMENT BASED ON RADAR
TECHNIQUES TO TURN INTO A MUSEUM OF INDUSTRIAL ARCHEOLOGY**

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ABSTRACT

Industrial archeology is an interdisciplinary field involving the material or immaterial evidence of documents, artifacts, structures, human settlements, and urban or natural landscapes created for or by industrial processes. The interventions proposed for the restoration and improvement of the building involve the actions over both brick masonry as



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well as masonry walls. The rehabilitation provides a valuable vantage point on the complex process of transforming an industrial space into a modern museum, while preserving the building's historic value. The transformation process will involve a thorough analysis of the historical and architectural value of the hall. A key critical point in this process is the assessment of the masonry structure and the identification of defects that must be addressed before transformation. Non-destructive testing (NDT) techniques are used for this, as they provide valuable information about the integrity of the structure without causing other damages. In this paper, we present the assessment of an industrial hall based on radar techniques in order to be transformed into an industrial heritage museum. The radar techniques are geophysical methods that uses electromagnetic pulses in the radar and microwave frequency spectrum to detect anomalies in underground utilities and concrete substructures and are well-defined NDT assessment methods which can be used to obtain a high-resolution image of the subsurface and accurately evaluate the condition of structures.

Keywords: Industrial Heritage, Nondestructive Evaluation, Radar Techniques, Convert, Rehabilitation.



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REMOTE SENSING OF METALLIC STRUCTURES JOINED BY RIVETS FROM ARCHITECTURAL HERITAGE ELEMENTS

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ABSTRACT

Europe's cultural heritage preservation benefits by cutting edge technologies. Architectural heritage, i.e., antique buildings and small architecture elements are affected by natural (floods, earthquakes, fires) and anthropic (pollution, intentional damaging action), degradation processes being dependent on characteristics of used materials as well as the object's age, working conditions and random events. It is essential to perform structural health monitoring analysis for further preservation and restoration. Usually, cultural heritages are evaluated for example, for art objects by Photographic Documentation and Digital Imaging using UV or infrared light, X ray Radiography, Infrared Reflectography, Infrared thermography, meanwhile, for structures, classical non-destructive testing procedures as ultrasound, eddy current, or even ground penetrating radar can be employed. Non-destructive testing methods of the cultural heritage items have evolved once with development of data acquisition and processing procedures leading to their complete and accurate assessment. The extension of the research towards the architectural conductive heritage monitoring with electromagnetic sensors led to development of adaptive sensors arrays customized to the specific application. The methods involve both numerical approach and experimental investigation. This paper proposes to present the results obtained at the



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non-destructive testing by electromagnetic method of metallic structures from historical architectures, jointed by rivets, in order to emphasize the eventually discontinuities which favours the corrosion acceleration. Estimation of the location of the cracks was carried out using a 5x5 sensor array and a super resolution algorithm received signals processing.

Keywords: Cultural Heritage Structures, Non-Destructive Testing, Sensors Array.



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DESIGNING THE PEDIATRIC EMERGENCY SERVICE AND POLYCLINIC BY USING THE ADDIE MODEL IN INTERIOR DESIGN

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ABSTRACT

The realization of the procedure followed in interior design within a method increases the quality of the finished design. The creativity skills of those who receive design education are therefore developed using a variety of instructional design models. The most well-known illustration of instructional design models is the ADDIE model. This model is a five-step, systematic manual that outlines what should be done at each stage of the curriculum. In the teaching process of many disciplines, the ADDIE model is used as a method that aids in understanding, visualizing, and categorizing the problem. In this study, it was examined what effects using the ADDIE model in interior architecture education has on students' ability to generate original ideas. By enhancing the creative thinking development potential of students who receive design education in the design process, it is hoped that the study will reveal original and qualified designs. The waiting rooms of pediatric emergency services and polyclinics serve as the study's source of data. The ADDIE model's stages were followed as the designs for these sample spaces were put into action. With the help of two groups of five fourth-year interior architecture students, two different spaces were designed.

Keywords: ADDIE Model, Creativity, Design Education, Interior Design.



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DISCIPLINE AND AMBIVALENCE IN ARCHITECTURAL REPRESENTATION PRACTICES

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ABSTRACT

Since the 16th century, the separation of time-space notions from each other has served to commodify both time and space. The tools of representation were also disciplined to serve this system. Organizing 'disciplines' and 'professions' was part of the same process. This disciplined look began to use the tools of representation not as a means of establishing an authentic experience with the world, but to serve the desire to appropriate a commodified and transcendent space imagination. A disciplined look describes an order, and any ambiguity is the enemy of this order. Bauman, in his books "Liquid Modernity" and "Modernity and Ambivalence", talked in detail about the drive for order and the war against ambivalence of modernity. The 'author architect', who is the actor of the disciplined profession, tends to represent the measurable features of the space. He/she assumes that he/she can appropriate the commodified space by transferring it to the representation plane, reorganizes it and reapplies the organized transcendent idea to the physical world. Thus, since he/she has created a transcendent image of space, spaces constant changes as space-time are ignored, and it is tried to be kept in a certain form like a permanent monument. The whole system here is based on the illusion that there can be a conjugation between the transcendent idea on the representation plane and the physical world. If we look at the architectural practices that develop based on the understanding of time-space against the disciplined architectural profession and their relationship with representations; Instead of commodified transcendental space, we need to talk about a time-space idea where we accept that every moment of space has different characteristics. We can see architecture not as a practice that appropriates space and transforms it into a monument by creating a transcendent image of it, but as a practice that intervenes in a constantly transforming being at certain moments and continuously. We can see representational practices as one of the ways of subjectively relating to this variable, mystical, atmospheric world of existence.

Keywords: Representation, Ambiguity, Ambivalence, Discipline, Space-Time.



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AN EXPERIENCE OF “A GERIATRIC LIFE WORKSHOP”

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ABSTRACT

Architectural structures are formed and shaped according to social requirements. Nursing homes, which were referred to with negative notions such as elderly dormitories in the past, are now called geriatric life and care centers. Geriatrics is a field of health that makes it possible for the elderly to receive the necessary support, treatment, and adaptation to the diseases and changes that people encounter as they get older, and “Geriatric Life Centers” were created for this purpose. In this direction, these centers are expected to provide solutions to the health problems of the elderly, to meet their accommodation, and to provide social and cultural activity areas. Undoubtedly, our task as architects is to design buildings where older people can happily spend the last years of their lives. For this purpose, it is aimed to design a care and living center in the 2022-2023 Fall Semester Studio 7 Workshop where the elderly can feel at home and receive the necessary care and treatment. In this study, student projects, the architectural design process and the final products of the Studio 7 Workshop will be presented. The students were asked to design a ‘visitor-friendly’ elderly living and care center that is integrated with the environment, provides rehabilitation services that meet the individual and social needs of the elderly, and consists of open, semi-open, and closed spaces. First of all, in the first weeks of the design process, the development of geriatric life and care centers from past to present in our country and in the world was analyzed in order to collect data on the subject and create a needs program, and the project’s needs program was created by reading the projects designed on this subject. The connection between the land and the environment was analyzed by making trips to the area for environmental analysis, and the process was supported by in-class criticals in the following weeks. With the studies produced at the end of the semester, it was seen that the students approached the subject sensitively, proposed spatially adequate projects that connect with the environment, are visitor-oriented, and offer areas where the elderly can socialize and integrate with nature.

Keywords: Old Age, Nursing Home, Geriatrics Life and Care Center Design, Architectural Design Workshop.



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**AN ASSESSMENT OF SURFACE WATER ANALYSIS IN BEKI RIVER BASIN,
ASSAM**

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ABSTRACT

Surface water is the utmost vital natural resource obtainable in the form of river, ponds, lakes and reservoirs. Mapping of water bodies acting a chief protagonist in assessing its areal extent as well as its quantification. However, mapping is a stimulating chore the forward-thinking techniques of remote sensing and geographical information system are moderately convenient as they make available precise estimation and appropriate information. The major rivers of Beki River Basin are such as Beki, Palla, Bhelengi, Chaulkhowa, Nakhanda, Kaldiya, Pahumara etc. The Normalized Difference Water Index (NDWI) method used to identify the different categories of surface water of the study area and tested various water parameters in pre and post monsoon period using weighted arithmetic index method. Main linear water bodies initiate in this area are perennial rivers and non-perennial rivers as well as the main Beki River which drift over a length of 135.13 km. Likewise, the areal surface water bodies in this extent are ponds, tanks, lakes and reservoirs with wetlands and beel covering an area of about 11.9 km².

Keywords: Beki River Basin, NDWI, Weighted Arithmetic Index.



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RECONCILING THE LOCAL AND THE MODERN: AN OVERVIEW OF HOUSING DESIGNS IN ABDULLAH ONAR'S ARCHITECTURE

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ABSTRACT

Modern architecture in Cyprus was linked with the colonial experience on the island, and the approaches specific to postwar modernism continued increasingly after the colonial period. Towards the end of the 1950s, Turkish Cypriot architects who grew up abroad started to open their offices in Nicosia and started to contribute to this process. Turkish Cypriot Architect Abdullah Onar was one of them, who was active in the practice until 1996. His office presents significant examples, the majority of which were housing projects whether single family houses or apartments blocks. In his archives, there are 640 projects including apartment, mixed-use building, garage, factory, hotel, cinema, mosque, bank, printing house, passage, club, dining hall and gas turbine, office block, restaurant, assembly and theatre buildings. This paper aims to give a brief overview about Onar's architectural approach throughout the housing projects he designed in the island. This kind of a general analysis is essential to read the architectural atmosphere and the traces of modern life during that period in Cyprus. Particularly the houses, designed between late 1950s and late 1970s, seem to have developed through a reconciliation between the local and the modern, which also coincides with the anxieties discussed in the international architectural circle of the period. The term "critical production" implies modern architecture practices that are re-evaluated in the context of local conditions in different geographies. In this study, Onar's housing projects are critically analyzed through this concept

Keywords: Cyprus, Modern Architecture, Abdullah Onar, Housing Design, Critical Production.



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PERCEPTION OF OPEN PUBLIC SPACES AS URBAN LANDMARKS: A STUDY AMONG COLLEGE STUDENTS

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ABSTRACT

Kevin Lynch describes five elements of the city image in his well-known book: The Image of the City. Landmarks, one of these five elements, are examined in this research. Studies on urban landmarks usually concentrate on single buildings or objects as landmarks and investigate them as external reference points in cognitive mapping. This study initially examines whether some open public spaces are perceived as landmarks and their attributes in perceiving them as a landmark. The study also investigates whether these open public spaces can be considered as one of other four elements of the city image and how it relates to perceiving an open public space as an urban landmark. College students were the participants of this study. After their eight-week training on the basic concepts and case study sites related to landmarks and open public spaces, students who agreed to participate this study (74 students) were asked to pick an urban landmark in their living environment and to visit the selected site with an observation checklist to fill out. Then, students were interviewed about the reasons for selecting their site. Initial results illustrate that most participants have chosen parks and squares as urban landmarks and considered these areas as nodes simultaneously. In addition to this, even though there are a wide range of answers related to the reasons for selecting an open space as a landmark, interview results revealed that 'ease of accessibility' and 'having memorable moments' were most repeated responds to perceive the open public space they chose as an urban landmark.

Keywords: Urban Landmarks, Public Space, City Image.



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**RESPONSIBLE CULTURAL HERITAGE CONSUMPTION FOR SENIOR
TOURISTS IN THE WALLED CITY OF NICOSIA**

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ABSTRACT

Cultural heritage consumption plays a pivotal role in senior tourism, offering unique experiences and fostering a sense of connection with the past. This study explores the concept of responsible cultural heritage consumption for senior tourists in the historic Walled City of Nicosia. The primary objective is to examine the preferences and challenges faced by senior travelers in accessing and engaging with cultural heritage sites. Employing a qualitative research approach through interviews, on-site observations, and document analysis, were performed to obtain necessary data about the experiences of senior tourists in the context of cultural heritage attractions. The research findings reveal that senior tourists highly value authentic cultural experiences and seek opportunities for meaningful interactions with local heritage. However, barriers such as limited accessibility and lack of age-friendly facilities hinder their full participation in cultural heritage facilities. The study highlights the need for tourism stakeholders to adopt responsible practices and create inclusive environments, ensuring that cultural heritage remains accessible and enjoyable for all age groups. This research contributes to developing targeted strategies for responsible tourism management in Nicosia's Walled City by addressing the unique needs and expectations of senior tourists in cultural heritage sites. This may help to foster a harmonious coexistence between cultural preservation and sustainable tourism development.

Keywords: Responsible Tourism, Cultural Heritage Consumption, Senior Tourists, Inclusive Access, Nicosia Walled City.



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WORLD HERITAGE AREAS OF ISTANBUL: ANALYSIS OF CRITERIA AND APPROACHES TO CONSERVATION

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ABSTRACT

Istanbul is an important metropolis known worldwide for its historical and cultural richness. Istanbul's World Heritage sites are special regions recognized by UNESCO worldwide as having outstanding universal values. Among the most important criteria accepted for Istanbul's World Heritage sites are the necessity to represent historical, cultural or natural heritage, to offer unique and extraordinary values, to have a universal meaning for all humanity and to be under protection. Various approaches are being adopted for the protection of World Heritage sites in Istanbul. Conservation approaches in these areas include various purposes such as restoring the historical texture, reducing environmental impacts, promoting sustainable tourism practices, increasing the participation and awareness of local people. What are the criteria for the selection of the World Heritage Sites of Istanbul and the approaches and strategies applied for their protection? constitutes the research question of the study. In this study; The selection process of Istanbul's World Heritage Sites, compliance with UNESCO's World Heritage Criteria, conservation strategies for the preservation of Istanbul's historical texture, world heritage site management and urban planning, urban conservation, urban design, approaches within the scope of sustainable tourism. and to evaluate the applications reflected in the space. The method of the study is an original study on world heritage sites and Istanbul world heritage sites and conservation, based on observations and interviews in the field in Istanbul and the literature on the subject. As a result, in this article; We can say that conservation strategies, world heritage site management and urban planning, urban conservation, urban design and sustainable tourism strategies are needed to preserve the historical texture of Istanbul.

Keywords: World Heritage Sites, Conservation, Criteria, Historical Heritage, Awareness.



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A HERITAGE MANAGEMENT MODEL PROPOSAL FOR AN INTEGRATED CONSERVATION OF CULTURAL HERITAGE: CASE OF ORDU HISTORICAL CITY CENTER

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ABSTRACT

Historic cities formed over a long period, become unique blends of different cultures and are invaluable as open-air museums. They represent their societies and their urban/architectural spaces, which are indispensable areas of social memory, worth preserving. However, especially urban pressures cause irreversible destruction in historic cities ruining the unique cultural and historical identity. In this sense, urban and architectural conservation practices are critical for more effective conservation and sustainability of the historic city. Some steps in urban and architectural conservation surely have been taken in Türkiye so far, but the concept of an effective management plan as an outcome of the contemporary conservation approach, has not yet been introduced to overcome the implementation problems in the traditional residential areas sustainably. Consequently, it is observed that the original historic architectural and urban qualities are fading away every day, through the destruction of these areas. These problems are believed to be due to the lack of an integrated heritage management system parallel to a legal framework including planning, urban and architectural conservation, as well as all stakeholders of this issue. In this context, Taşbaşı Quarter of Ordu Historic City Center is chosen as the case, in search of a solution to this widespread problem in Türkiye, to propose a heritage management system and maintain a digital database that will provide an integrated heritage management model between urban planning, urban and architectural conservation. This model and the digital database are expected to set an adaptable framework and model for similar cases in Türkiye.

Keywords: Cultural Heritage, Integrated Conservation, Heritage Management, Ordu Historical City Center, Taşbaşı Quarter.



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A METHODOLOGICAL APPROACH TO THE SUSTAINABILITY OF CULTURAL HERITAGE: CULTURAL HERITAGE IN DIGITAL GAME DESIGN

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ABSTRACT

One of the most important problems brought about by globalization in recent years is the loss of importance of locality and cultural values and the destruction of cultural heritage data with the destructions caused by natural disasters. Realizing this, societies develop various solutions to protect their cultural data. With the development of technology and the spread of digitalization, tangible cultural heritage data has been digitized and transferred to a digital archive. Intangible cultural heritage data are also stored in digital media as literary. In order to ensure the sustainability of cultural heritage values in memory, tangible and intangible data should be presented as a whole. The transfer of cultural heritage to future generations should be done not as a pile of knowledge, but as a fun and exciting form of learning. This study includes a methodological approach to the design of digital games, which have become popular especially among young people in recent years, with cultural heritage data. With this methodological approach, it is aimed to provide informal learning by increasing the curiosity and awareness of young people playing games designed with different cultural heritage values and players from all age groups. With this methodological approach developed, exemplary studies were carried out on cultural heritage areas with the students of Eskişehir Osmangazi University Department of Architecture, Architectural Project Studio. In the project studio, the students first identified the tangible and intangible data of cultural heritage areas, and then created digital game setups with these data.

Keywords: Tangible and Intangible Cultural Values, Digital Game Design, Cultural Heritage, Sustainability.



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WHO OWNS IT? THE NEGLECT OF CULTURAL HERITAGE: AN EXAMPLE FROM CENTRAL ANATOLIA

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ABSTRACT

The phenomenon of identity based on belonging, created by societies within defined borders, derives its Dynamics from all kinds of heritage left by ancestral descendants. The elements of cultural heritage, the foundations of which were established centuries ago, live on with the ownership of these phenomena by societies. In order for heritage values to survive, it is necessary to recognise and identify the value of cultural heritage, irrespective of its origin. Societies, which must be the guardians of cultural heritage elements, have different attitudes towards the interaction with this heritage element and the heritage value. The understanding of protection shown by the societies that connect with the cultural heritage assets with a sense of belonging and the approaches to heritage of the societies that do not see the cultural heritage asset as more than a physical good are diametrically opposed. In some societies, administrative decisions taken about the cultural heritage value are met with the reaction of the public with the thought that they may harm the heritage, while in some societies, the heritage itself is ignored by the administrative units. In this context, the ancient city of Isauria, which is located in Central Anatolia and contains traces of the Roman period in Anatolia, and the archaeological heritage sites belonging to the same ancient culture have been examined in the recent historical period and their current status. In this respect, the destructive attitude of the local people towards cultural heritage and the dynamics of this attitude are questioned.

Keywords: Owing, Cultural Heritage, Archaeological HeritageS, Central Anatolia



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THE ANCIENT CITY OF CNIDUS (KNIDOS) AND ITS NATURAL ENVIRONMENT

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ABSTRACT

The characteristics of the natural environment wield substantial influence over urban development and the shaping of cities. A city's integration with its natural surroundings ensures the maintenance of an existence, where the interplay between urban dynamics and territorial features is mutually impactful. Changes occurring in time within the city's expanse can yield significant effects on urban life and the pattern of settlements. This research seeks to explore the interconnectedness of nature and the city, its transformations over time and their repercussions on urban planning and architectural structures. In this study, the ancient city of Cnidus (Knidos), which is an important culture, art and trade center of the Caria region, is examined. The information obtained from the literature on the urban settlement process and the natural environment of the city were analyzed in parallel. The relationship between the ports, which are formed as a natural result of the topography, and the architectural structures, has been evaluated together with the natural environment data. The arrangement and orientation of buildings within the city are examined through a comparison of topographical characteristics and temporal changes. As a result of the study, it has been revealed that the positioning of the buildings in the city of Cnidus is clearly dependent on environmental information.

Keywords: Cnidus (Knidos), City Settlement, Natural Environment.



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EXPLORING THE WIDE-RANGING ECOSYSTEM SERVICES OF RIPARIAN VEGETATION ON A GLOBAL SCALE

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ABSTRACT

Riparian vegetation is a significant component of river systems, and due to its transitional nature between aquatic and terrestrial ecosystems, it possesses versatile socio-ecological functions. These areas establish a crucial connection between humans and the natural environment by offering a wide range of ecosystem services in physical, chemical, biological, and social aspects. Riparian vegetation supports biodiversity and human well-being by providing a variety of ecosystem services, including erosion control, water quality improvement, habitat provision, flood control, nutrient cycling, recreation, and heatwaves. These functions are vital for the health and functionality of aquatic ecosystems. This study aims to present the current state and structure of scientific publications on river ecosystems and riparian vegetation by examining the overall status of research conducted between 2000 and 2023. A bibliometric analysis will be employed to review scientific literature and evaluate research methodologies concerning riparian vegetation. Furthermore, by embracing the ecosystem services approach, it provides a general overview of the ecosystem services provided by riparian vegetation. In this regard, the study is important in identifying the necessary information and gaps required to assist decision-making and planning processes involving riverbank areas. The ecosystem services provided by riparian areas are crucial for the sustainability of water resources, the preservation of biodiversity, and human well-being. Therefore, the conservation, management, and restoration of riparian habitats are critical steps in ensuring ecosystem health and sustainability.

Keywords: Riparian Vegetation, Riparian Areas, Ecosystem Services, Ecosystem Functions, Sustainability.



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EVALUATION OF HYDROLOGICAL PROCESSES IN THE GALA LAKE NATIONAL PARK BASIN USING THE SWAT MODEL

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ABSTRACT

Changes in land cover and land use (LC/LU) caused by human activities are one of the main causes of hydrological process changes in watersheds. Therefore, understanding the interaction between land use activities and hydrological processes is crucial for supporting sustainable water use planning. The aim of this study is to evaluate the impacts of LC/LU changes on hydrological processes within the boundaries of Gala Lake National Park. In this context, land cover maps will be generated using supervised classification method with Landsat images from 1983, 2003, and 2023 to assess LC/LU changes. The SWAT (Soil and Water Assessment Tool) model, which is one of the widely-used semi-distributed basin scale eco-hydrological models for evaluating hydrological processes, will be utilized. With the SWAT model, the potential effects of LC/LU changes on hydrological processes such as runoff, infiltration, evapotranspiration and erosion will be evaluated. The impact of land cover and land use changes on hydrology provides vital information for integrated land use and water resource management. Water resource development planning should consider the changes in LU/LC to ensure sustainable development in the watershed. This study aims to contribute to the sustainable management of water resources.

Keywords: Land Cover/land use, SWAT Model, Basin Processes, Water Resources Management, Gala Lake National Park.



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**URBAN ARCHITECTURE IN BALTIC COUNTRIES
BETWEEN CENTRAL EUROPEAN AND NORDIC (SCANDINAVIAN) TRENDS**

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ABSTRACT

The investigated problem is, how the identification of the Baltic peoples is reflected in their urban culture, in recent and former capitals. Considered aspects: - impacts made by the Russian immigration on urbanization, - how and to what extent the local traditions and special heritage are preserved in the urban architecture. Latvia and Estonia belong to the "Baltic" region in a narrower sense: former Hansa towns with merchant architecture: stores under the roofs of old houses from the Middle Ages, especially in Riga, which is the largest capital city, and already postmodern, too. In Tallinn, the "globalized" shopping complex around the Soviet-style Hotel Viru in the downtown may symbolize the postmodern character of the Estonians, as well. Vilnius stands out with its baroque heritage (unlike medieval Tallinn and Riga), and its special couleur locale, too: the old and new quarters are built cyclically, as an onion, not combining with each other. Thus, modern architecture is built around the downtown, while in Tallinn it is almost imposed in the downtown. Kaunas, after being a former Tsarist military garrison city, became the capital of independent Lithuania in 1920-30-ies; then, in Soviet-occupied Lithuania, Kaunas played the role of the "very, real" Lithuanian city, in contrast to Vilnius; all this has been reflected also in its external appearance, too. Consequently, in all three Baltic countries, the trend towards Nordic cultures and globalized urban culture is unequivocal, also in Lithuania which was a rather a Central-European country albeit nowadays strives to be Nordic. At the same time, all three Baltic countries take special care of their national heritage in the urban culture, too.

Keywords: Baltic, Urban, Nordic, Identity, Post-Soviet.



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A STUDY OF THE PROPERTIES AND COMPONENTS OF MEDICINAL AND AROMATIC PLANTS IN A DESERT REGION OF ALGERIA

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ABSTRACT

The present work, is about the dosage of the phenolic compounds of two Saharan plants, Anvillea radiata and Astragalus armatus and their insecticidal (Aphis gossypii) and microbial (Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Candida albicans) effectiveness. The dosage of the total polyphenols and flavonoids is carried out by the method



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of Folin-Ciocalteu and $AlCl_3$ respectively, the phenol contents of *Anvillea radiata* ethanol = 91.06 ± 13.8 , *Astragalus armatus* ethanol = 82.17 ± 10.8 , *Anvillea radiata* chloroform = 24.17 ± 4.12 and *Astragalus armatus* chloroform = $35.28 \pm 13.3 \mu\text{g EGA} / \text{mg DM}$. While the flavonoid contents remain low for all extracts (*Anvillea radiata* ethanol = 5.40 ± 2.8 , *Astragalus armatus* ethanol = 0.3125 ± 0.2 , *Anvillea radiata* chloroform = 1.6 ± 0.6 and *Astragalus armatus* chloroform = $0.312 \pm 25.7 \mu\text{g EGA} / \text{mg DM}$). Both chloroform and ethanolic extracts from *A. radiata* revealed antibacterial activity against *staphylococcus aureus* bacilli, with zones of inhibition of $10 \pm 2.6 \text{ mm}$ and $16.5 \pm 2.1 \text{ mm}$ respectively, on the other hand the four extracts of the two plants showed an insecticidal effect for the three doses.

Keywords: Characterization, Antioxidants, Phenolic Compounds, Flavonoids, Saharan Plant.



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A FIELD STUDY OF THE BIODIVERSITY CHARACTERISTICS OF A DAM IN AN ALGERIAN DESERT REGION

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ABSTRACT

The ecological knowledge of the artificial wetlands in particular the lakes of dam, of the development of their biological richness and their potentialities and their bio-ecological and socio-economic potentialities. Due to their biological diversity and crucial ecological roles that they play, these natural regions are extremely significant. Due to their significant capacity to provide proteins, they are also regarded as among the most productive environments, making them of tremendous economic importance. There are various wetlands in Algeria, notably the Biskra region, which features a number of sites that are significant both locally and regionally.both national and global. These are either natural sites, which are typically represented by wadis, or artificial sites, such as dams like the one in the Foug El Kherza study area, which, despite the diversity and richness of its natural resources, has received very little attention in terms of their knowledge and development. The dam that is the focus of our study is situated in the Saharan bioclimatic stage, where ecological elements are



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susceptible to significant daily and seasonal changes. Ecological elements are subject to significant daily and seasonal variations. Characterization of the site's biotic and abiotic components has been made possible by the bio-ecology study of the biological resources undertaken from October 2019 to Mai 2020 on the 29 ha Foum El Kherza Dam artificial wetland. By examining and keeping track of a number of physico-chemical factors related to the soil, water, and the diversity of flora and fauna, it also enabled us to gain a general understanding of its significance. As a result, we identified the type of substrate, the physicochemical, bacterial, and biological quality of the water, as well as the presence of 33 plant species, 42 phytoplankton species, and 155 animal species, including 103 invertebrate species, 03 fish species, 04 amphibian species, 07 reptile species, 34 bird species, and 7 mammal species. This method allowed us to value the site's biological resources, assess their significance, and formulate management and conservation recommendations related to its socioeconomic status from the standpoint of long-term development.

Keywords: Ecological Diagnostic, Humid Zone, Barrage Foum El Kherza, Biodiversity, Physical-Chemistic Soil Analysis, Water Quality, Biskra.



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ELIMINATION OF INORGANIC AQUEOUS EFFLUENTS WITH THE USE OF CHEAP BIO-ADSORBENTS HYBRID

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ABSTRACT

Protecting the environment, including surface waterways, is one of the pillars of sustainable development, which represents a major challenge for the future of mankind and our planet. It is important to point out that Algeria is making great efforts to protect the environment and reduce chemical and biological pollution, well aware of the environmental and economic stakes involved in the problem of liquid waste. In fact, chemical substances are constantly being released into the environment, and can threaten the balance of aquatic ecosystems and human health. Consequently, to limit pollution, laws must be respected by setting standards for harmful substances discharged into water. This study's goal was to synthesize and construct biomaterials of the cationic and anionic types. These substances were utilized as adsorbents in waters that had been contaminated by various adsorbates that were probably prevalent in the environment. In order to describe the various materials, various approaches



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(IRTF, DRX, MEB, BET, and ATG/DTA) will be used. Studies on the adsorption by these substances will be conducted while changing a number of variables, including pH, mass, concentration, and temperature. Removal of effluents in aqueous media, particularly the adsorption technique, which appears to be well suited to remove pollutants due to its shown efficacy as well as for financial reasons, using inexpensive adsorbents such agricultural and industrial wastes.

Keywords: Characterization, Different Materials, Water Treatment, Bio Adsorbents, Adsorption.



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INSTITUTIONAL IMPROVEMENT MASTER IN FOOD AND FARMING ASSOCIATION IN PAKISTAN: A REVIEW BY DR FAISAL

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ABSTRACT

An Institutional Advancement Master with regards to the Food and Horticulture Association alludes to an in expert aiding nations and associations improve and reinforce their institutional systems connected with food security, farming, provincial turn of events, and related areas. Institutional advancement centers around improving the adequacy and effectiveness of foundations, like government offices, non-administrative associations, research organizations, and different substances engaged with food and horticulture. The job of an Institutional Advancement Master can incorporate different errands and obligations, including surveying existing arrangements and guidelines connected with food and horticulture, recognizing holes and regions for development, and assisting with growing new approaches that advance feasible turn of events and food security. Planning and carrying out limit building programs for government authorities, ranchers, and different partners to upgrade their abilities and information in regions like farming creation, promoting, and asset the executives. Working with associations to work on their inner designs, cycles, and frameworks. This could include enhancing work processes, dynamic cycles, and correspondence channels. Working with cooperation and associations among different partners, including government bodies, common society associations, confidential area elements, and neighborhood networks, to advance composed endeavors for food security and practical horticulture. Supporting the turn of events and execution of information assortment frameworks to accumulate data on agrarian practices, creation, market patterns, and other important variables. This information can illuminate proof-based direction. Aiding the plan, execution, and the board of ventures pointed toward further developing food security, rustic turn of events, and rural practices. This could include planning assets, observing advancement, and assessing project results. Bringing issues to light about the significance of manageable farming practices, food security, and provincial turn of events. This might include upholding for strategy changes, directing studios, and spreading data through different channels. Supporting examination drives that add to working on farming works on, expanding efficiency, and addressing difficulties connected with food security and country improvement. With regards to the FAO, an institutional advancement Master would work intimately with state run administrations, neighborhood associations, and different partners to recognize explicit requirements and difficulties inside the food and farming area. They would then create and execute procedures to improve institutional limits, cultivate joint effort, and advance maintainable improvement in accordance with FAO's objectives and rules. Generally speaking, the job of an institutional advancement master in the Food and Farming Association is crucial for guaranteeing that nations and districts have the essential institutional designs and abilities to successfully resolve issues connected with food security, agribusiness, and country improvement.

Keywords: Alludes, Aiding, Errands, Accumulate, Ventures, Crucial.



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**ZnBr₂-MEDIATED SYNTHESIS OF BLUE-LIGHT-EMITTING CSPBBR₃
PEROVSKITE QUANTUM DOTS VIA SUPERSATURATED
RECRYSTALLIZATION**

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ABSTRACT

Recently, cesium lead halide CsPbX₃ (X = Cl, Br, and I) perovskite quantum dots (QDs) have attracted tremendous interest for their promising application in designing active layers of light-emitting diodes owing to their remarkable photophysical properties. However, the blue-light-emitting mixed halide (chloride and bromide) based CsPbX₃ QDs lag behind their green and red counterparts due to chloride low defect tolerance nature. Therefore, tuning the green emission of CsPbBr₃ quantum dots (QDs) to blue through quantum confinement effects has received considerable attention due to its defect-tolerant properties. However, the synthesis of such a blue-emitting QD has been challenging. Herein, supersaturated recrystallization was successfully implemented in an ambient atmosphere to synthesize strongly quantum-confined blue-emitting CsPbBr₃ QD with ZnBr₂ covering the blue spectrum. The structural and optical characterization of as-synthesized QDs reveals that the particle size of the QDs decreased by incorporating an appropriate amount of ZnBr₂ solution into the perovskite precursor solution. As a result, a significant blue shift of the optical band gap from 2.30eV to 3.02eV is observed. The electronic band structure investigation of pure and Zn-doped CsPbBr₃ have been done for experimental verification using the first principle density functional theory (DFT) calculation. The present work provides an alternative strategy for synthesizing strongly quantum-confined QD materials for photonic devices such as light-emitting diodes and lighting.

Keywords: Quantum Dot, Nanocrystal, Halide Perovskite, CsPbBr₃, Blue Light Emitting, Quantum Confinement, Supersaturated Recrystallization.



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ROOM TEMPERATURE SYNTHESIS OF CSPBBR₃ PEROVSKITE NANOCRYSTALS WITH OLIVE OIL AND OLEYLAMINE

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ABSTRACT

All-inorganic halide perovskites have gained tremendous interest in developing optoelectronic devices including solar cells and light-emitting diodes due to their extraordinary properties such as simple solution preparation, high photoluminescence quantum yield (PLQY), narrow full width at half maxima (FWHM), and tunable emission over visible region. Despite such advantages, their properties still require improvement for commercial applications. This paper focused on the structural and optical properties of cesium lead-bromide (CsPbBr₃) perovskite nanocrystals (NCs). Here to address the objective, we applied a room temperature approach under ambient conditions for the synthesis of CsPbBr₃ NCs using capping ligands such as oleic acid/oleylamine (OA/OAm), and olive oil/oleylamine (OO/OAm) separately. The result reveals that high crystallite size was achieved during olive oil was used instead of carboxylic acid (oleic acid). Similarly, larger size distribution and shape of CsPbBr₃ NCs was obtained when olive oil replaced with oleic acid. On the other side, the optical property indicates that high photoluminescence (PL) as well as lower absorption was achieved in OA/OAm. Moreover, the size-dependent PL decay time of CsPbBr₃ NCs shows that perovskite NCs prepared with OO/OAm indicate longer decay time. Thus, the proposed capping ligand reveal improvements in the structural and optical properties. Finally, this work gives good insight for further study and replacement of expensive and acidic ligands by cost-effective and eco-friendly ligands for commercial optoelectronic device applications.

Keywords: Perovskite Nanocrystals, Ligand, Oleic Acid, Olive Oil, Optical Property.



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THE KEY DRIVERS FOR THE WATER STRESS: AN EMPIRICAL ANALYSIS FROM BALKAN COUNTRIES

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ABSTRACT

Background: Water stress is a phenomenon that describes when water demand is greater than the amount of water available at a particular period and also when water is of poor quality and restricts its usage. Nowadays, droughts and water scarcity are no longer rare or extreme events in Europe, and about 20% of the European territory and 30% of Europeans are affected by water stress during an average year. The growth in industrialization and economic development, which increases water usage, water ecosystem transformation, and a massive loss of biodiversity, etc., are causing water scarcity. Purpose: This study analyzes the main factors for water stress and lack of water in Balkan countries. Design/Methodology: Data proceedings are time series indicators for Balkan countries, with an annual frequency of 2002 – 2021. The statistical approach in panel data model is used to find statistical significance, direct on-driven fixed factors, etc. Findings: Fixed effects panel regressions demonstrate that water stress in this region is statistically significantly affected by climate change indicators (temperature and precipitation), economic indicators (water productivity, agricultural land, and growth of the gross domestic product), population growth, political stability, etc. Practical Implications: The government's role in supplying water and lowering water stress must build an efficient management mechanism and policies for water reserves such as groundwater, surface water, or rainwater. Dictated by the global and regional circumstances of climate change, governments should initiate strategic efficient plans for the good-using and sustainability of water.

Keywords: Waters Stress, Climate Change, Econometric Water Estimation, Balkan Countries.



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A STUDY OF THE EFFECT OF MULTI-WALLED CARBON NANOTUBES ON POLYBUTYLENE TEREPHTHALATE

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ABSTRACT

After preparing test samples by adding the following ratios of multi-walled carbon nanotubes (MWCNTs) (0.2, 0.4, 0.6, 0.8, 1, 1.2 % wt) to polybutylene terephthalate (PBT) using extrusion connected to the mixer, the effect of adding MWCNTs on the crystallization behavior at isothermal and non-isothermal conditions of PBT has been studied using differential scanning calorimetry at the following cooling rates (2, 5, 10, 20) °C/ min. In general, the results showed that the addition of carbon nanotubes led to change in both the crystallization temperature and the melting range. This change depended on each of the different ratios of adding MWCNTs to PBT and the cooling rates, where the structure of the carbon nanotubes contributed to the improvement of both the crystallization rate and its behavior. This addition led to an increase in the initial temperature of crystallization and the peak temperature of crystallization with an increase in the loading of MWCNTs at the different cooling rates. As well, it was observed from the results that the presence of MWCNTs made crystallization start at an early stage because these CNTs acted as a strong nucleating agent that enhanced the nucleation of PBT when compared to neat PBT. It also caused a change in the melting behavior of the nanocomposite (PBT/MWCNTs) by moving the PBT chains, thus achieving a higher order for these chains. With the increase in the ratios of MWCNTs, the amount of crystallization increased, thus there was a change in the physical and chemical properties, which in turn affects the final properties of the composite material.

Keywords: Multi-Walled Carbon Nanotubes, MWCNT.



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THE EFFECT OF MACHINING PARAMETERS ON MILLING PROCESS OF RENE108 TYPE NICKEL-BASED SUPERALLOYS

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ABSTRACT

In this scientific study, the authors have dealt with slot milling of nickel-based superalloy. Nickel-based superalloys are among the most difficult materials to machine because it has high thermal strength, it is prone to hardening, carbides cause severe abrasion to the tool, and it has very poor thermal conductivity. Slot milling is a specific issue as it is characterized by rapid tool wear and frequent tool breakages. This is why reconditioned tools are often used in an industrial setting, which can significantly reduce tool-related costs. The machining parameters, such as cutting speed and feed employed also has a major impact on the lifecycle of the tool and the quality of the machined surface, so choosing the right cutting parameter is an important factor. Therefore, the authors have chosen three cutting speed values and three feed values. The effects of the tool geometry of the new and the renovated tools and the cutting parameters were tested focusing on the cutting forces and the average surface roughness on the bottom of the milled slots. The aim was to determine the best cutting parameters combination and investigate the effects of the new and the restored tool geometry. In all cases, the results show that the new tools were superior to their reconditioned counterparts. When choosing the technological parameters, it is advisable to use lower cutting speeds and higher feed rates.

Keywords: Ni-based Superalloys, Slot Milling, Cutting Forces, Cutting Torques, Surface Roughness.



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HEAT TRANSFER PERFORMANCE OF HYBRID NANOFLUID THROUGH SEPARATION-FLOW PASSAGE

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ABSTRACT

The essential enhancement of diverse heat transfer applications hinges upon the synthesis and thorough exploration of thermophysical attributes inherent to novel nanofluids. A paramount investigation pertains to the heat transfer coefficient of MWCNT-TiO₂/DW, operating as the operational fluid within a segregating flow conduit subjected to a heating flux of about 10000W/m². The nanofluid was rendered stable through the inclusion of surfactants, facilitating an assessment and comparative analysis of heat transfer efficacy across a backward-facing step, alongside an evaluation of fluid thermophysical attributes. Notably, a remarkable augmentation was observed, approaching a doubling of the heat transfer coefficient, akin to the impact achieved by the incorporation of 100% MWCNT additive to the foundational water substrate, within the Reynolds range spanning from 2000 to 10,000. This augmentation holds significant import, presenting the potential for cost reduction in nanofluid production, while concurrently upholding heightened performance levels. This behaviour is expected to be due to the various methods of heat transfer through fluid and the combination of these methods presented by MWCNT and TiO.

Keywords: Energy, Nanotechnology, Nanofluid, Heat Transfer.



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TRUST BASED SECURITY SCHEME FOR WIRELESS SENSOR NETWORKS

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ABSTRACT

Resource limitation feature of wireless sensor networks brings the network performance very poor under various security attacks. Flooding attack is the one type that affects the sensor networks with lot of fake packets to consume more network resources. This doesn't allow the legitimate users to communicate effectively. It is also required to save the energy of sensor nodes under flooding attack. In this work, we proposed energy efficient trust value based defense method against flooding attack in sensor networks. The proposed scheme uses trust metrics based routing and SMAC protocol for energy efficiency. Trust values are computed based on the channel information and a priori information. The most trusted node is being used as the cluster head which plays a key role in data forwarding. This assures the trustworthy communication among the nodes in the network. Energy is a valuable resource in wireless sensor networks. The nodes in WSN will communicate with other nodes with limited energy in many applications. Changing energy sources is not feasible in most of the networking scenarios. This makes the network lifetime as a critical factor in the design of WSN. Hence energy efficient method of communication in WSN is essential. The energy consumption issue in the network becomes crucial when sensor nodes are engaged in malicious activities. Hence, it is considered that energy in the sensor nodes can be preserved by avoiding the attackers. In this proposed method, a Trust based Energy Efficient Security Scheme is proposed in which SMAC protocol is used for energy conservation and the trust metrics are employed to deal with security problems. For improving security in WSN, assessing trust among neighbor nodes is very much essential. Generally, the schemes developed for efficient communication may only concentrate on routing based on energy or trust values. To provide both energy efficiency and secured routing, a new Trust based Energy Efficient Security Scheme (TEESS) with clustering approach has been proposed in this work. The proposed scheme is validated by simulation. The experimental result shows that the proposed method improves the performance of wireless sensor networks effectively.

Key words: Denial of Service Attack, Energy Conservation, Security, Trust Value, WSN.



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ISTANBUL'S HOUSING CRISIS IN THE POST-COVID ERA: CONSIDERING ALTERNATIVE SOLUTIONS

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ABSTRACT

Istanbul has been accommodating the largest amount of population as a metropolitan city in Türkiye. The city has struggled with the housing crisis in various time periods since 1950s. Through these times, Istanbul had squatter settlements, new regulations to legalise them and increase the housing supply with the Mass Housing Development Administration. However, there is another housing crisis post-COVID-19 era. Average rental house prices in Istanbul rose by over 600% between 2020 and 2023. This research focuses on the current demand and supply of housing with vacant housing, affordable housing projects and insecurity of private rented sector in the metropolitan city. Therefore; the data regarding housing and related issues are obtained from the official government agencies; General Directorate of Land Registry and Cadastre, Turkish Statistical Institute and Istanbul Statistic Office of Istanbul Metropolitan Municipality. The data is analysed with descriptive and inferential statistics. In addition to unearthing the existing struggles in the Istanbul case, the research investigates the effective policies in the various countries regarding affordable and inclusive housing. Afterwards, potential solutions are studied to overcome the current struggle of citizens which include national and local policy suggestions.

Keywords: Housing Crisis, Macro-Micro Solutions, Post-COVID Era, Istanbul.



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**THE LANDSCAPE PROTECTION PLAN IN WETLAND AREAS WITH
GEODESIGN APPROACH: ULUABAT LAKE, TÜRKIYE**

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ABSTRACT

The aim of Landscape planning increases, improves or creates the natural, social/cultural and economic landscape resources with their visual/aesthetic values. Because of the biodiversity, ecological life functions and protection status potentials such as Ramsar Wetland, and also management threats, Uluabat lake was chosen as a study area. The ecological balance of the lake has been damaged by human activities and thus its carrying capacity is being challenged. The purpose of this research is to create a landscape protection plan and develop strategies with conservation priority for Uluabat Lake. To reach this aim, Geodesign, being an ecologically based approach that systematically examines the landscape, was chosen as the main method. Geodesign, systematically studies the landscape by creating models of representation, process, evaluation, change and impact, and relates each step to each other. The Habitat, Water, Soil functions were analyzed and revealed spatially. Plan principles and provisions have been determined within the scope of the protection plan that ensures healthy ecosystem functions and habitat sustainability. As a consequence, it is determined, the cultural activities affected the ecological systems of the lake negatively. Therefore Uluabat Lake, first 200 meters from the shore and its reeds were chosen as the core area. For this reason, it should be implemented the spatially specified strategies and restored the protection-use balance for the sustainability of the lake ecosystem. The method and findings of this research can set an ecologically protection model for the supporting system of relations and functions of protected wetland areas like Uluabat Lake.

Keywords: Geodesign, Protected Area, Wetland, Ecologically Based Strategies, Landscape Planning.



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HOUSING COOPERATIVES IN EUROPE AS A FORM OF SOCIAL ENTERPRISE

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ABSTRACT

In Bulgaria some Social enterprises are focused on providing housing and shelter for peoples with disabilities or risk of exclusion. The activities of these organizations are sponsored predominantly by local, state or EU projects. Thus, the House of Opportunity Programme creates family-type houses and offers 2 years of residential care and support to young people, leaving specialised institutions for children deprived of parental care. The Bulgarian "Chitalishta" traditionally created boarding houses for students from rural villages, supported schools and created public libraries. In other European countries (Austria, Germany, Switzerland, Spain, etc.), the Social enterprises, working as housing cooperatives, have important role in housing policies of their main cities ("Red Vienna" public housing model during the 1920s; now BWS administrates 22 000 apartments throughout Austria). According to the Austrian Statistical Office, 102 cooperatives were active in the housing sector. Limited-profit housing organizations are engaged in the construction and management of housing, construction of housing for third parties or car parks, where 84 organisations are engaged in the Household-related services. In Germany, the Housing cooperatives are active in both urban and rural contexts, and align under a sector federation with non-cooperative type social housing companies. In Zurich, about 25% of the city's entire housing stock is occupied by the not-for-profit accommodation. Thus, the cooperative housing becomes a negotiated process with policies and decision makers, together with the social housing providers.

Keywords: Housing Cooperative, Social Enterprise, Social Policy.



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PENTECOSTAL CHURCHES SITE SELECTION AND ENVIRONMENTAL REALITIES IN DELTA STATE: MISUNDERSTANDINGS AND MISTAKES

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ABSTRACT

Although progress has been made in examining different aspects of the environmental crisis in Nigeria, literature is yet to focus on the impact of site selection and the activities of Pentecostal churches in Delta State. In this study, we extended the literature on environmental realities by examining how Pentecostal churches have contributed to the environmental crisis in Delta State. The aim of this study was to explore: 1) how the site selection methods of Pentecostal churches affect the environment in Delta State; and 2) how neighbours perceive their experience of noise pollution in Delta communities. There is a dearth of literature on such associations, which makes this article timely, especially among the inhabitants of Delta State. A purposive sampling method was used to recruit participants. Twenty participants living in different areas close to selected Pentecostal churches were involved in the study. Semi-structured interviews were used to collect data. The face-to-face interview data were recorded and analysed using the method of qualitative inductive content analysis. Five themes were identified from the data of the transcribed interviews: illegal location of Pentecostal churches; site selection in areas within much human residence; regular daytime church services; frequent nighttime church services; and frequent quarrels with neighbours. Pentecostal churches are continually being located in residential areas, and noise pollution emanates from their day and night services.

Keywords: Pentecostal Churches, Environment, Delta State, Noise Pollution, Site Location.



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**EVALUATION OF NEVŞEHİR CITY CENTER IN TERMS OF BARRIER-FREE
LANDSCAPE DESIGN**

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ABSTRACT

As a result of the progress achieved by the disability rights movement in the last 50 years, barrier-free landscape design has become a prominent necessity for modern cities. Barrier-free landscape design, which holds great importance in urban planning and design processes, aims to improve the quality of life for disabled individuals and eliminate social, physical, and environmental barriers to their full participation in society. Public open spaces and urban green areas, such as squares, parks, and roads, are vital urban areas for both disabled and non-disabled individuals to socialize, and these areas should be designed to provide equal opportunities for all users. In this study, the barrier-free landscape design was addressed for Kayseri Avenue and Atatürk Boulevard, which have the most human mobility in the city center of Nevşehir. The study examined these routes within the framework of national standards and universal design principles. As part of the study, landscape applications such paths, sidewalks, ramps, urban equipment elements, and plant elements made along the designated route were examined in terms of accessibility, usability, comfort, and sensory aspects. Issues were identified, and design recommendations were proposed to facilitate the daily lives of disabled individuals through disabled-friendly design.

Keywords: Urban planning, Disabled, Universal Design, Accessibility, Nevşehir, Urban Landscape, Barrier-free, Landscape Design.



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GENETIC DIVERSITY ANALYSIS AND BIOLOGICAL ACTIVITY OF NATURAL POPULATIONS OF *EUPHORBIA RESINIFERA* O. BERG IN MOROCCO

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ABSTRACT

To evaluate the genetic diversity of Euphorbia resinifera O. Berg using ISSR markers. 12 natural populations were chosen from its geographical area of and analysed. Using 14 ISSRs primers generated 101 polymorphic bands corresponding to a percentage of polymorphism nearly 80%. This high percentage of polymorphism suggests that there is an important genetic diversity in this melliferous and medicinal species in Morocco. While the mean of I and Ht indicates that there is a high genetic diversity in this species. Thus, the high values of PIC and Rp parameters show that the ISSR primers are very informative and effective to analyse the genetic diversity of E. resinifera. The results of the AMOVA showed that the high degree of variability is present within population. The high value of FST suggest that the studied populations are highly differentiated in agreement with very limited gene flow between each population. Additionally, the genetic structuring of populations into two groups obtained from UPGMA and Structure analysis revealed a dependence on the geographical origin of the populations. the results of antimicrobial activity of the aqueous extract showed a pronounced antifungal activity against the tested strains. The data obtained will be useful to define conservation strategies and improvement programs of this melliferous and medicinal species.

Keywords: *Euphorbia resinifera*, Genetic Diversity, Medicinal, ISSR, Polymorphism, Morocco.



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PARAMETERS TO SUITABLE LAND SELECTION FOR URBAN AGRICULTURE

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ABSTRACT

Urban agriculture refers to producing, processing, and distribution of agricultural goods in urban areas for the community. Local, regional, and national governments play an important role in identifying the suitability of vacant lands for urban agriculture. It's known that urban agriculture has a high potential for the urban population, the economy, and the environment, all together for making a healthier city as well as a healthier community. However, urban agriculture is also subject to risks (e.g., air, water, soil quality) due to environmental conditions in cities. Today in the cities numerous and continuous anthropogenic activities going on that cause a high pressure on the quality of the urban environment. Determining suitable areas for urban agriculture is crucial for the sustainable development of urban areas. Considering the benefits of urban agriculture for sustainable development, city managers must identify the areas in the cities where sustainable urban agricultural development is safe for the community. There are some criteria studied in the literature used to evaluate this suitability such as climatic factors, soil quality, water availability, accessibility, market, etc. To better planning of land use in urban agriculture while considering environmental issues, should be given priority for the selection of land suitability assessment parameters. In this study, therefore, these parameters are discussed, and drawn a suitability assessment framework to enhance urban agricultural practices in the cities.

Keywords: Land Selection, Pollutants, Healthy Cities.



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IMPERFECTION IN ARCHITECTURE

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ABSTRACT

Criticism is a tool to understand how architecture interacts with power, with the world, and with each other today. Today algorithms are identifying what is visible by analyzing what we like to see the most. This state of looking takes place in the area that we begin to ignore and become numb, in other words immobile. This paper takes the well-known term 'mobility' in a different context, where 'immobility' implies an order established by dominant and hegemonic forms. I consider the term mobility as a breakdown and re-establishment of the dominant perspective with inspiration from the philosopher Jacques Ranciere. One of the conditions of mobility that bring about another kind of interaction is 'imperfection'. The purpose of this research is to use the notion of 'imperfection' in a critical context to reflect on the creative perspective. The physical incompleteness of the space creates a situation where it can re-establish its context, materiality, and relations. Imperfection or incompleteness is the possibility of differentiation as a design approach. So how can architecture become imperfect? Or, as Ranciere brought up the question; how can it undo its own mastery to create a new sensible world? The research draws on approaches and discussions on the concept of 'Distribution of The Sensible' by Jacques Ranciere, as well as imperfect and incompleted cases as an activator of "re-distribution".

Keywords: Imperfection, Aesthetics, Criticism, Distribution of the Sensible.



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THE IMPORTANCE OF THE CONCEPT OF PRIVACY IN TRADITIONAL TURKISH HOUSES AND ITS IMPACT ON ARCHITECTURAL PLAN DESIGN

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ABSTRACT

The house, as one of the basic needs of all living things, has affected people's intellectual and life concerns throughout history by drawing contradictions. Turkish houses emerged typologically with the settlement of Turks in Anatolia as a result of several factors. The concept of culture emerges as a result of the plan typology of the houses and the establishment and shaping of their connection with the external environment. Protecting the privacy of family members stands out as one of the most important factors in the traditional houses of Islamic countries. The importance of the privacy issue affects the layout of the interior spaces, their size and their connections with other spaces. The importance of privacy affects the layout, size and connections of interior spaces with other spaces. This subject alone can differ in different geographies and families, inspired by economic conditions, culture, customs and also the climate. Traditional Turkish houses are designed with a keen understanding of the need for seclusion and personal space, reflecting the common cultural values and social norms in Turkish society. In traditional Turkish houses, privacy is related to the arrangement of living spaces and the planning of inner courtyards. In this study, providing the subject of privacy in the traditional Turkish house of the Islamic period is based on the view of creating a direct effect on the plan typology of the houses. Within the scope of the research, in addition to ABSTRACT studies, four different case studies were handled to embody the subject and the connection of the concept of privacy with culture and the effect they had on the plan typology were investigated concretely.

Keywords: Privacy, Turkish House, Plan Typology, Culture.



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**THE EFFECT OF COLOR ELEMENT ON VISUAL PERCEPTION IN
ARCHITECTURAL SPACES**

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ABSTRACT

Architectural spaces are environments that are established and developed on the basis of providing the physical and psychological comfort of people. Architectural environments are the environments where people spend the most time with all their functions. According to research, people spend 87% of their daily lives in architectural spaces without distinction of function. The colors used in the spaces are one of the factors that directly affect the mental and physical health of people, just like light and temperature. Colors are responsible for the perceptions they create on people and for a series of conscious and subconscious stimuli in our psycho-spatial relationship. The effect of color in architectural spaces, when used effectively as an interesting phenomenon that greatly affects visual perception, has the potential to evoke certain emotional responses and shape the overall experience of building users. The effects that colors create on the perception of space should be changed depending on the function. It is possible to encounter this feature frequently in traditional architectures. In many existing examples such as mosques, churches, bazaars, houses and palaces, it is possible to see how colors are used to convey the perception of space suitable for functions. In addition to all the concrete examples that exist, extensive research has been carried out over the years to unravel the complex relationship between color and its psychological effects, enlightening architects and designers on the optimum selection and application of color elements. However, despite all this, in many modern buildings constructed today, functions and services are ignored without paying attention, while it is sufficient for people's perception of space, but also causes the disappearance of spatial identities. In this study, the effect of the colors used in traditional historical buildings on the perception of space has been examined and the results have been compared with modern buildings that have similar functions.

Keywords: Color in space, Perception of Space, Space Function, Psycho-Space Relationship.



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**EXAMINING THE CONCEPT OF PLACE-MAKING: THE CASE OF BURSA
CUMHURİYET STREET**

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ABSTRACT

In historical cities, urban public open space's identity is a fundamental aspect that contributes to shaping the identity of communities. Urban identity is the foundation to place attachment and a sense of belonging to the place. The urban identity reflects people's traditions, culture, aspirations, needs, and future. The architectural elements in urban areas succeeded in expressing the identity of the community and maintaining the continuity of identity. The city's identity determines by the city's geographical context, cultural level, architectural elements, local traditions, lifestyle, and quality of public open spaces. In recent years the multi dimensional place-making concept with a dynamic social context become an interested studying area in increasing urban identity. The concept of place-making coines to describe a multi-disciplinary approach in planning, designing, and urban public open spaces management to improve the urban environment and the quality of life. In this study, the conceptual framework of the topic drew by putting forth the concept of place and place-making to improve the quality of places in historical public open spaces. The studying area is Cumhuriyet Street in the historical center of Bursa City. The street is located in the traditional trade center as a pedestrian way. Due to Bursa's strategic position as the first capital of the Ottoman Empire, at the confluence of main trade roads, the historical background examine to demonstrate its potential in creating a place-making concept in the city's historic core.

Keywords: Place-Making, City Identity, Cumhuriyet Street, Bursa.



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RISING BEYOND CHALLENGES: EMPOWERING THE URBAN POOR WITH AFFORDABLE AND ECOLOGICAL HILLSIDE HOUSING SOLUTIONS AMIDST SLOPES AND RISKS IN PAHARTALI, CHATTOGRAM

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ABSTRACT

Bangladesh's main issue, the creation of an affordable housing project for the poor in Pahartali, Chattagram. The property, located on a modest slope beside Fay's Lake, offers a promising working zone and amenities for the desired user group, although loan installments must be paid. However, the site's slopes and severe rainfall offer a landslide risk, requiring strong structures. This initiative intends to build safe, cheap homes for the urban poor while considering site environmental issues. Climate-resilient, comprehensive, low-cost housing is suggested in this conference report. It encourages women's empowerment, micro-businesses, and self-sufficient communities while considering geography. The study uses qualitative and quantitative top-down eco-adaptation. Eco-friendly design, affordable sustainable resources, and ecological equilibrium are studied. The results reveal that architectural interventions can address community dynamics, risks, and environmental challenges throughout development. Strategies and policies support these activities. The garment industry, day labor, sharecropping, microbusinesses, and fishing support Pahartali's urban poor, according to socio-demographic data. Urbanization and deforestation landslides undermine community ownership. The concept includes site selection, design, infrastructure, community engagement, and sustainable urban poor housing funding. This technique addresses overcrowding, eviction, water shortages, and poor services. The analysis shows that rising nations with moderate slopes and landslide problems need cheap housing. Sustainable urban poor housing with micro-business zones, communal gardens and integrated farming. This enhances living conditions and economic and social progress in these communities. The housing proposal eliminates landslide risks, protects the environment, and provides low-cost, community-centered housing for the underprivileged.

Keywords: Affordable Housing, Urban Poor, Landslide, Resilience, Eco-Adaptive.



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**INVESTIGATION OF THE EFFECT OF THE SANDPLAY THERAPY IN THE
OPEN AREA**

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ABSTRACT

Sandplay is a creative form of therapy to work with children in a nonverbal manner. Sandplay therapy helps the person develop social skills and act as a therapy method where they can reflect and repair their inner world. Today, sand therapists perform sandplay therapy on different children, but this and similar therapy methods are generally performed in closed rooms and places. The aim of this study is to test the feasibility of sandplay therapy method in an open area for children with ASD and investigate its effect on the development of social skills. In addition, the reorganization of sandplay areas where children with disabilities receive education and treatment, and the introduction of design proposals for integrating them with sandplay therapy in the open area, have been one of the other objectives of this study. Experimental group in this study consisted of 2 children with Asperger's Syndrome (a type of autism) and individual sandplay therapy work was carried out in the open area. The effect of open area sandplay therapy method on the development of autistic disabled people was compared with the values taken before and after the sandplay therapy sessions. The findings revealed that increasing interaction with the society contributed to the development of children with ASD socially and psychologically. In addition, the development of suggestions for the design of barrier-free sandplay areas and the evaluation of the connection between sandplay therapy and design in the open area were made.

Keywords: Sandplay Therapy, Children with ASD, Play Area; Social Skill.



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**SENSORY GARDEN DESIGN PROPOSAL FOR CHILDREN WITH AUTISM
SPECTRUM DISORDER**

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ABSTRACT

It is expected that autistic people who need Special Education and Rehabilitation Centers will socialize, strengthen their weaknesses, gain self-confidence, and show mental and physical development thanks to these centers. These people need sensory gardens specially designed for them to improve psychologically and physically and to participate in society. Therefore, in special education and rehabilitation centers, sensory gardens designed with the user group in mind are required in order to support the recovery of children with autism and to increase their sensory stimuli. The aim of this study was to plan the close environment of IFSER as a sensory garden for children with autism and to develop a design proposal in this direction. The working process consisted of field survey and analysis, determination of user requests and needs, and development of a sensory garden design proposal. In addition, the plant and structural design features of the study area were evaluated in terms of landscape design, thanks to the interviews with the center staff. The usability of the outdoor conditions of this center by children with disabilities was examined. According to the examples of sensory gardens and the data obtained, there are no sensory garden designs in Türkiye. In Türkiye, the Park and Garden Directorates of the relevant municipalities and the Ministry of Environment and Urbanization should consider the sensory aspect while designing the disabled gardens, especially for autistic children.

Keywords: Sensory Garden, Autism, Child With Autism, Therapy, Special Education and Rehabilitation Center.



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VIETNAM'S POLICY ON CO₂ EMISSIONS IN THE CONTEXT OF ACCESSING INTERNATIONAL AGREEMENTS

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ABSTRACT

Participating in the international market through bilateral and multilateral FTAs contributes to Vietnam's outstanding achievements in economic development. However, high economic growth also causes Vietnam to emit a large amount of CO₂ into the atmosphere. Reducing CO₂ emissions in the context of trade opening is a matter of particular importance, having significant influence, interacting, and deciding the country's sustainable development; is the basis and premise for making guidelines and policies for socio-economic development, ensuring national defense, security, and social security. The article presents the situation of CO₂ emissions in Vietnam over the years. At the same time, the report studies Vietnam's policy related to CO₂ emissions. On that basis, the paper proposes some recommendations related to the implementation of policies on CO₂ emissions. This article is based on: (i) an Analysis of documents, reports, and data on the situation of CO₂ emissions in Vietnam by Vietnamese state agencies and research agencies such as the Ministry of Natural Resources and Environment, School, National Center for Socio-Economic Information and Forecast (under the Ministry of Planning and Investment), Steering Committee for the Implementation of the United Nations Framework Convention on Climate Change, and the Kyoto Protocol in Vietnam; (ii) Legal reports, research articles in relevant journals, and the Internet; (iii) Legal documents issued by competent state agencies of Vietnam related to environmental protection in general and greenhouse gas emission reduction in particular.

Keywords: CO₂ Emission, CO₂ Emission Policy, Carbon Credit Market.



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FLOATING MARKET CULTURE IN CAN THO - VIETNAM

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ABSTRACT

Can Tho is a province in the Mekong Delta. This is a land (plain) with many rivers, so commercial activities taking place on the river take place widely and form a floating market system. Floating market is a special type of market, trading activities in the market take place on the river and attract many people to buy and sell. Products traded at the market are mainly fruits, vegetables and agricultural products. Commercial activities taking place on the river have made an important contribution to the formation of a special culture, floating market culture. This cultural form reflects the geographical specificity and richness of the Mekong Delta in agricultural production. Floating market culture in Can Tho also has important values in tourism development in the Mekong Delta in general and Can Tho in particular. Currently, Vietnam is implementing many solutions to preserve and promote the cultural value of the floating market in Can Tho. This study is carried out by the method of cultural research, actual survey, analysis to have appropriate research content, thereby clarifying the cultural content of the floating market in Can Tho, contribute to the study of culture in the Mekong Delta and Vietnam.

Keywords: Vietnam, Can Tho, Floating Market, Culture, Mekong Delta.



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THE ROLE OF BLOCKCHAIN TECHNOLOGY IN PROMOTING CIRCULAR ECONOMY DEVELOPMENT

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ABSTRACT

Blockchain technology can play a significant role in promoting circular economy development by enhancing transparency, traceability, efficiency, and trust in supply chains and resource management. The circular economy aims to minimize waste, promote sustainable consumption, and maximize the lifespan of products and materials. The objective of studying the role of Blockchain technology in promoting circular economy development is to comprehensively assess and understand how Blockchain can contribute to the principles and goals of the circular economy. This study aims to explore the various ways in which Blockchain technology can enhance transparency, traceability, efficiency, and trust within supply chains and resource management, ultimately advancing the transition towards a more sustainable and circular economic model. Methods adopted: Analytical and synthesis methods are essential for conducting comprehensive research on the role of Blockchain technology in promoting circular economy development. These methods involve breaking down complex concepts into manageable parts (analysis) and then combining those parts to form new insights and perspectives (synthesis). Main findings: The main findings of a study on the role of Blockchain technology in promoting circular economy development would encompass a range of insights and conclusions derived from the research. These findings shed light on how Blockchain can advance circular economy principles and practices effectively. These collectively contribute to a comprehensive understanding of how Blockchain technology can effectively promote circular economy development by enhancing transparency and traceability; improved resource management; promotion of sustainable consumption; facilitation of circular supply chains; mitigation of counterfeiting and fraud; economic benefits and cost savings; environmental impact and sustainability. Conclusions: While Blockchain technology offers considerable potential to influence the promotion of the circular economy model positively, its successful implementation in a circular economy requires collaboration, standardization, and consideration. Carefully consider technological, economic, and social factors. In addition, addressing challenges such as scalability, energy consumption, and interoperability will be critical to realizing the full benefits of blockchain in promoting the development of a circular economy.

Keywords: Blockchain, Technology, A Circular Economy.



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**BIM-SUPPORTED CROSS-CURRICULAR FACILITIES MANAGEMENT
TRAINING FOR AEC STUDENTS**

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ABSTRACT

The operational phases of a building's life cycle are often overlooked in AEC (Architecture, Engineering, Construction) education, which typically focuses more on the design and construction phases. New government policies and building information management standards increasingly place an important emphasis on a building's operational aspects. Decisions made during the design and construction phases can directly impact the operation and maintenance of a building. This study presents a cross-curricular educational method for teaching BIM-integrated facilities management (FM). This method emphasizes the connections between different requirements and promotes a holistic view of knowledge. In this educational paradigm, teaching is interdisciplinary, with course topics distributed across the curricula of two courses, and students from two different universities work together to create models for the design, construction, and operational aspects of a building. During this process, students work on their projects with the end goal in mind from the beginning. Building Information Modeling (BIM), an increasingly widespread project production method is used to facilitate collaboration and FM-related requirements. The study also included a survey questionnaire to assess the teaching methodology's effectiveness, the significance of integrating BIM-FM, and the learning experiences of students. According to the survey results, this education raised awareness among AEC students about FM requirements, thereby fulfilling this demand in the design and construction processes.

Keywords: BIM, Facilities Management, Cross-Curricular Education.



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**A REVIEW OF POSTGRADUATE PROGRAMS FOR PROJECT AND
CONSTRUCTION MANAGEMENT EDUCATION**

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ABSTRACT

The number of architectural and civil engineering faculties has been significantly growing as a result of the several new universities that have emerged in Türkiye and the Turkish Republic of Northern Cyprus in recent years. It is crucial to integrate project and construction management courses into the curriculum of architects and civil engineers in accordance with this progress. Postgraduate programs in project and construction management offer the training required to become project and construction managers for the construction industry. This research paper intends to examine the past and present conditions, update them, and investigate postgraduate programs in project and construction management in Türkiye and the Turkish Republic of Northern Cyprus. It also serves as a reference for researchers on this subject. Although comparable research has been done in Türkiye, the Turkish Republic of Northern Cyprus was included in the study because there hasn't been any research done there. In order to accomplish this, the second section provided a historical overview of the history of project and construction management. Project and construction management postgraduate programs were investigated and researched in the third section. The current state of postgraduate programs in project and construction management was described in the fourth section. Seventeen common headings were established in order to compare the information in the postgraduate programs. Information for each postgraduate program was specified under the common headings, and charts based on this information were created. Postgraduate programs in project and construction management were assessed in the fifth section, and the findings were presented.

Keywords: Project, Construction, Management, Postgraduate, Education.



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NOT COMPLYING WITH THE KNOWLEDGE OF THE TECHNIQUE IN REPRESENTATION: A READING ON THE SECRET OF KELLS

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ABSTRACT

*(Architectural) representation, a tool of expression, can act as a language with various techniques. The fact that representation is constructed to reach a consensus on what is represented strengthens its resemblance relationship with language. For this reason, each architectural representation tool (plan, section, perspective, and so on) establishes its own information frame. A trained eye can easily understand what is represented while staying within these knowledge frameworks. On the other hand, this study deals with the forms of representation in which the said frames are resolved and focuses on the problem of wrong that emerges with these breaks. The question of the study is as follows: "Can there actually be a potential that is wrong in the architectural representation/drawing?" In this context, sections from the 2009 animated movie *The Secret of Kells*, directed by Tomm Moore, will be discussed as an example in this study. Mainly images, including sections from architectural spaces, will be utilized. These images will be used to reveal information frames of representation and their refraction forms, and a conceptual reading will be made on the problematic of wrong in (architectural) representation. At the end of the study, the creative areas and different perception forms of the problematic of wrong will be evaluated.*

Keywords: Architectural Representation, Architectural Drawing, Knowledge Structures, The Secret of Kells, Perception.



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**LABOR MARKETS AND BUSINESS REGULATIONS IN CENTRAL AND
EASTERN EUROPEAN STATES**

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ABSTRACT

One of the main goals of all governments in the world is to keep the unemployment at low levels. However, despite all the efforts made by national governments and international institutions, many states still confront high rates of unemployment. Some of the studies analyzing the impact of labor market regulations on unemployment show that more rigid employment regulations are associated with higher levels of unemployment. Meanwhile, the relationship between business regulations and unemployment has not been extensively examined in the literature. However, some researches that indirectly investigated this link have concluded that a more burdensome business environment discourages small entrepreneurs and large investors, the consequence being an increase in unemployment. Considering these aspects, the present study intends to conduct a statistical investigation of the labor market and business regulations' effects on unemployment in 11 Central and Eastern EU economies during the period 2000–2020. Our results show that, over the entire analyzed sample, neither labor market regulations nor business regulations had any significant effects on unemployment. However, the individual cointegration coefficients showed that market-oriented labor regulations diminished unemployment in Bulgaria, Poland and Romania, but raised it in Hungary, Latvia, Lithuania and Slovenia. Meanwhile, market-oriented business regulations decreased the unemployment in the Czech Republic, Latvia and Poland, but raised it in Croatia and Slovenia.

Keywords: Unemployment, Labor Markets, Labor Market Regulations, Business Regulations, Central and Eastern EU States.



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BIOPHILIC URBAN OASIS: GREEN ROOF DESIGN SOLUTIONS FOR ISTANBUL'S CONCRETE JUNGLE

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ABSTRACT

As urbanization continues to transform cities, providing green spaces that not only counteract the concrete environment but also promote residents' well-being has become a significant challenge. In response, the concept of biophilic green roof design has gained prominence as a solution for creating urban oases that reconnect people with nature. This study delves into the practical implications of biophilic principles in green roof design, with a focus on Istanbul's distinctive concrete landscape in the housing context. Therefore, this study investigates how biophilic design qualities can be integrated into green roof designs in Atakent Province, an area characterized by modern housing complexes. The conceptual framework of this study revolves around the use of biophilic design qualities and techniques to enhance architectural ecological quality and individuals' reconnection to modern urban spaces. To investigate the impact of green roofs on individuals' reconnection to nature, a case study was conducted based on the redesign of eighteen rooftops. Through a mixed-method approach, the research compares two independent groups – users of green roofs and concrete roofs—using an independent samples T Test to assess respondents' physical comfort and well-being. Accordingly, the findings provide empirical insights into how green roof designs in concrete jungles can positively influence an individual's spatial comfort. By proposing a structured framework to underpin the biophilic green oasis design model, this study promotes a sustainable urban development approach and highlights the importance of the need for the sustainable development of Istanbul's modern cityscape.

Keywords: Biophilic Design, Green Roof Design, Sustainable Development, Urban Oasis, Istanbul.



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ARCHITECTURAL ANALYSIS OF LATE PERIOD QUARANTINE STRUCTURES IN THE RED SEA: KAMARAN QUARANTINE STATION

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ABSTRACT

From 14th century to 20th century quarantine structures were established in order to prevent spread of contagious diseases. In particular, quarantine structures were established in port cities or on islands for isolation, disinfection or treatment. In 19th century quarantine councils were established and many international sanitary conferences were held in which quarantine regulations and conventions were discussed. After the cholera epidemic in 1865, at the International Sanitary Conference held in 1866, it was decided to establish a quarantine structure near the entrance of the Red Sea for regular monitoring of Muslim pilgrims and maritime transport. By considering its location and physical characteristics, Kamaran island was chosen as a location to construct the quarantine station. This research focuses on one of the largest quarantine structures built in 19th century as the Kamaran quarantine station that has not been adequately addressed in the literature by means of architectural perspective. This study tries to find answers to the questions of how the local architecture reflected to the buildings of Kamaran quarantine station, whether it is affected or not by quarantine structures that have been built before, and what are the effects of quarantine regulations and conventions on the architectural structures of the station. By answering these questions, architecture of Kamaran quarantine station was defined in terms of settlement layout, function, construction technique and material of buildings and infrastructure applications.

Keywords: Quarantine Station, Lazzaretto, Cultural Heritage, Kamaran.



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DESIGN PRINCIPLES OF THE AMSTERDAM SCHOOL

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ABSTRACT

The Amsterdam School is an architectural style that began to emerge in the beginning of the 20th century in the Netherlands. The general characteristics of this movement are distinctive brickwork, decorative components and a successful blend of traditional and modern elements. The rise of heavy industrialization and mass production, lead a group of architects and artists to seek a new approach on architecture that embraces the values of craftsmanship, individuality and nature. The facades of the buildings were distinctive in the use of traditional materials, brickwork patterns, dynamic sculptures and floating forms. Many of these forms and techniques were heavily influenced by the Indonesian traditional architecture and crafts, as a result of the exclusive interaction between both cultures during the Dutch colonialism. Another important goal was to integrate the interior and the exterior spaces and to create a harmony between the architecture, the environment and the interior elements, ranging from furniture to tableware. The Amsterdam School architects believed that people who lived in beautiful homes become beautiful people, and ordinary men should have access to arts. The movement also had a significant impact on Dutch social housing while there was a growing need for affordable housing in Amsterdam. The architects came forward to design houses for the working class, that demonstrated the School's design principles by merging functionality and beauty.

Keywords: Amsterdam School, Netherlands, Dutch Architecture, Colonialism, Social Housing.



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USE OF COLOR IN CINEMATIC SPACE IN THE EXAMPLE OF THE FILM "LARA" (2009)

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ABSTRACT

For years, the art of cinema has been creating visually captivating and emotionally compelling atmospheres for its audience by employing various color schemes. The psychological use of colors in cinema, similar to lighting design, aims to direct the audience's emotional responses towards the film and enhance its aesthetic value through the visuals created. This study follows a semiotic approach, using the color factor both to enhance aesthetic value and to interpret the psychological meanings of spaces. It analyzes the colors used in film examples from the history of cinema to create a code and conducts spatial analyses specific to the film "Lara." Additionally, the study explores the connection and parallelism between the created atmosphere in the film and Picasso's artistic periods. The color factor, a significant element in the film's visual language, is used to enhance the emotional impact of the story. The director divides the film into three color schemes, drawing inspiration from Picasso's Blue, Pink, and Cubist periods, along with the stories behind those periods. As a result, the audience gets to see Lara's emotional states throughout the film in parallel with the colors used in Picasso's periods. In conclusion, the director Jan Ole Gerster's use of color in the film "Lara" (2019) plays a significant role in the film's visual language, almost becoming a separate leading character. The color factor supports the storytelling in terms of character, space, and city narratives, while also defining the boundaries between reality and fiction for the audience, establishing a strong connection with the story and aiding the audience in internalizing it. Overall, the use of color in the film "Lara" is evidence of the power of visual storytelling and the ability of colors to enhance and enrich a film's emotional impact.

Keywords: Color, Space, Perception, Cinema, Picasso.



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**DISCUSSING THE CONCEPT OF MULTI-SENSORY SPACE THROUGH THE
THEORY OF SENSORY INTEGRATION**

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ABSTRACT

In this study, it will be discussed whether the data obtained from scientific studies on sensory integration theory can contribute to the sensory relationship we establish with the spatial environment, which is defined as physical space in the literature. The sensory integration theory put forward by occupational therapist Jean Ayres is concerned with the sensory transfer process in the brain. Scientific studies in this field provide a lot of data on the senses, interactions between the senses, and the sense-environment relationship. The strong relationship between the senses and environmental factors is undisputed. The sensory integration literature allows us to obtain some data about the physical environment-sense relationship. In this context, it will be tried to discover at what points the information we obtained from the aforementioned universe intersects with the studies on the concepts of sense-space and multi-sensory space in the literature. In the study, the approaches of Norberg-Schultz, Marleau-Ponty, Pallasma, and Zumthor, who have studies on space and sense as a method, will be brought together and a conceptual reading will be tried on the data and relations of space by crossing the relevant approaches with the sensory integration literature. The aim of the article is to uncover how these various aspects combine to shape our understanding of the spatial environment. In this context, a qualitative methodology will be followed to discuss the reflections of theoretical concepts in space through various space examples. The approach that will be put forward as a result of the study is expected to form a bridge between the multi-sensory space and the sensory integration literature, and it is thought that it can offer a different perspective in this way.

Keywords: Sensory Integration Theory, Sense-Space, Multi-Sensory Space.



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**EXPLORING THE ROLE OF CONTEXTUAL FACTORS AND METAPHORS IN
ARCHITECTURAL ENVELOPE FORMATION**

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ABSTRACT

The exterior facade of a building acts as the initial point of contact for individuals, affecting their first perceptions of the building's characteristics. These impressions influence one's perceptions of the compatibility of the structure with its historical context, texture, materials, and overall surroundings. The architectural product experiences a process of integrating, where it integrates functional, spatial, symbolic, and semantic characteristics through its interaction with the physical and social environment. The designer's knowledge, cultural background, value judgments, and intended objectives greatly impact this formation. Architecture has a reputation as a medium through which feelings, thoughts, and social principles can be effectively communicated. Metaphors are frequently used as a means of communication within the field of architecture, which has been accepted as a language through which individuals communicate messages to one another via architectural structures. Architects use metaphors as a means of expressing and communicating their designs. While these metaphors can be linked to obvious formal characteristics, they can also have ABSTRACT and concealed connotations. The aim of this study is to investigate the impact of environmental elements and metaphors on the architectural design process, specifically in relation to the development of the architectural envelope. Within this specific context, significant study has been conducted on buildings that utilize metaphorical design approaches. The focus of this research consists in understanding the way in which these architectural structures connect with their surrounding environment and the different meanings they generate.

Keywords: Architectural Design, Contextual Integration, Architectural Envelope, Metaphor, Urban Interaction.



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PERCEPTION OR ILLUSION: EXPLORING THE DYNAMICS OF VISUAL INTERPRETATION

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ABSTRACT

Perception is generated through a combination of external cues and individualized cognitive processes, which occur along a temporal continuous. The spatial component of perception has a complex relationship to the visual sense. Within the field of architecture, the perception of a given environment is influenced by visual perception that is informed by information collected through a systematic and continuous process. Nevertheless, this perception could show variation and experience transformation in accordance with various time periods and individual attributes. The main goal of this investigation is to examine the dynamic and transformative characteristics of perception as it progresses through some factors. The phenomenon of changing and developing perception has the potential to either strengthen a current representation or understanding, or entirely replace it in order to generate an original signification or representation. The main goal of this research is to analyze the aforementioned occurrence in the field of optical illusions, with the intention of examining whether the observed change in perception indicates an actual change in cognitive perception or just an illusion effect. The term 'illusion' has been selected based on its connection to occurrences of misunderstandings, which can be supported by the flexibility and transformative ability of perceptual processes. In summary, the objective of this study is not to provide a conclusive decision, but rather to stimulate more questions. Through an exploration of the area of optical illusions, this study aims to generate alternative areas of investigation and broaden the current discussion.

Keywords: Perception, Illusions, Visual Perception, Dynamic Transformation, Optical Illusions.



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CROWDSOURCING BASED PROJECT APPLICATION, IMPACT ON ARCHITECTURE STUDENTS

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ABSTRACT

Crowdsourcing is a method that aims to produce solutions by bringing together the knowledge, skills and resources of a community. In architecture, crowdsourcing can be used as a platform where different ideas are collected and evaluated during the project design process. For example, if a new settlement is to be designed for a city, the views and needs of the community must also be taken into account. At this point, different ideas from the society can be gathered by using the crowdsourcing method, and by evaluating these ideas, a design can be realized in accordance with the needs of the society. Thanks to this method, the needs of the society in architectural projects can be better understood and projects can be made more fair and just. Crowdsourcing in education can be used to encourage student participation and knowledge sharing in the learning process. For example, feedback from students can be sought to create or update the content of a course and opportunities for students to develop their own projects and share them with other students. In addition, crowdsourcing in education aims to bring together students' specialized knowledge and skills in different fields. Properly trained architects can produce designs that meet people's needs and increase the well-being of society. For this reason, the use of crowdsourcing in architectural education and the interactive situation of the developing world order can enable future generations to be more conscious and offer more livable environments.

Keywords: Crowdsourcing, Crowdsourcing in Education, Architectural Education, Architectural Design.



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PERSONIFICATION OF MUNDANE OBJECTS: A SENSE OF (AN)OTHER

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ABSTRACT

Highlighting non-human attributes through the attribution of human characteristics establishes an emotional connection between the user and the product. While the existing literature extensively addresses the practice of personification in relation to branding and marketing terminology, this study uniquely shifts attention towards consumers' autonomy and their intricate emotional engagement with ordinary objects. Employing the Extreme Characters method, a select group of participants characterised by unique associations with specific mundane items were examined. Conducting a semi-structured narrative inquiry approach, the study delved into how these consumers integrate particular objects into their social and personal narratives. Conducted within the geographical boundaries of Türkiye, this study employed a combination of online and in-person dialogues to engage with a demographically diverse cohort of 10 individuals. Among these participants, a subset holds professional roles as product designers. Their backgrounds encompass a range of distinct experiences and expertise, contributing to the multifaceted perspective captured in this research. Of particular significance, the study deliberately excludes the overt impact of conventional marketing techniques on these products, allowing for a more unadulterated understanding of the participants' inherent connections. In conclusion, the research extensively examines the socio-cultural framework and the intricate ecosystem that envelops these non-humans in everyday life of consumers.

Keywords: Personification, Non-Human, Product, Mundane-Objects.



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INVESTIGATION OF NICKEL COATINGS ELABORATION BY CA AND CP

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ABSTRACT

The nickel electrodeposition process can have a significant effect on various aspects of the deposited coating, including its properties, characteristics, and performance. The parameters and conditions of the electrodeposition process can be adjusted to tailor the coating to specific requirements. Factors like bath chemistry, temperature, agitation, and current density should be carefully controlled and adjusted based on the desired coating characteristics and the specific application requirements. The present work aims to improve the surface properties, hardness, wear resistance and electrochemical corrosion resistance of copper. To this end, the influence of nickel deposition process on the elaboration of thin Ni layers on copper substrate were conducted by CP (chronopotentiometry) at 40 mA/cm² and CA (chronoamperometry) at -1V from watts bath for 10 minutes has been studied. The electrochemical behavior and the corrosion properties of the deposits in 3.5 % NaCl were investigated by means of d.c polarization measurements, open circuit potential and electrochemical impedance spectroscopy (EIS). The surface morphology of nickel deposits were analyzed by optical microscopy and whit light interferometry (WLI). The obtained results shows that the structure of nickel deposits is influenced by the current density. Nickel electrodeposition at -1V leads to an increase in the electrochemical corrosion resistance while the nickel coatings prepared under a processing current density of 40 mA/cm² exhibited the highest cathodic current efficiency, a good surface density, thickness and flatness. Moreover, that nickel deposits elaborated by CP presents a smoother surface with less nodules.

Keywords: Corrosion Resistance – Ni Coatings – CP – CA – Surface Morphology.



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**ELABORATION OF SEAWATER SAND-FLY ASH GEOPOLYMER CONCRETE:
SYNTHESIS, MICROSTRUCTURE, AND MECHANICAL BEHAVIOR**

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ABSTRACT

In the last twenty years, the availability of river sand has declined, posing challenges for many countries to satisfy their construction needs. Utilizing sea sand for construction has emerged as a solution to address the scarcity of river sand. This research aims to assess the properties of geopolymer paste derived from seawater and sea sand, which have gained popularity due to their abundance, cost-effectiveness, and environmental benefits. The investigation involved creating various geopolymer mixtures by adjusting ratios of seawater, sea sand, and alkaline activators. Results indicate that the geopolymer's compressive strength increased as curing time progressed, with seawater and sea sand playing a significant role in enhancing strength development. Furthermore, incorporating sea sand improved workability and reduced water requirements. Consequently, this study concludes that incorporating seawater and sea sand into geopolymer production offers a sustainable substitute for traditional concrete materials.

Keywords: Geopolymer, Seawater, Fly Ash, Sea-sand, Concrete and Mortar, Compressive Strength.



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A SUSTAINABLE PHANTOM IMAGING OF SUPERPARAMAGNETIC GRAPHENE COMPOSITES FOR ADVANCED DIAGNOTHERAPEUTIC APPLICATION

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ABSTRACT

In this experiment, a facile approach was made to synthesis graphene iron oxide nanocomposites from postharvest field waste of Pennisetum glaucum, an alternate to commercial graphite. They were fabricated by improved green technology using the extracts of Melia dubia and Prosopis juliflora. The composition ratio of iron oxide to graphite oxide have improved not only synergistic effect but also surface area with functionalization, high loading capacity, good conductivity. Various characterization techniques such as UV-visible spectrophotometer, powder X-ray diffraction (PXRD), Fourier transformation infrared spectroscopy (FT-IR), field emission scanning electron microscopy (FESEM), energy dispersion X-ray (EDX and vibrating sample magnetometer (VSM) were performed to check stability, colloidal dispersivity, particle size range, superparamagnetic property. The assay results proved the hemocompatibility of our composites was 5 % and up to 1 µg concentration as a safer dosage from the MTT assay with better biocompatibility. By Two-way ANOVA-balanced design, we observed that results were statistically significant for biofilm inhibition, antioxidant, and biocompatibility activities with a p value (<0.05). Besides, by resonance surface method, the composite yield parameters were analyzed using central composite design. The prepared nanocomposites reported X-ray attenuation potential almost equal to the commercial agents at much lesser dosage and also worked as potential contrast agents for multimodality X-ray-CT/MRI studies with better resolution for prognosis. Thus, our work



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enabled multimodality contrast applications and by paving a way with the introduction of a suitable drug, potentially opening up a new path for theranostic applications.

Keywords: Graphene Iron Oxide Nanocomposite Superparamagnetic Contrast agent X-ray-CT-MRI Bioimaging Contrast Imaging.



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CORRELATION ON PHYSICAL MECHANISM OF TITANIUM DIOXIDE-CHITOSAN MICRO-ENCAPSULATED FOR PHOTO DYES REDUCTION IN A MICROFLUIDIC DEVICE

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ABSTRACT

The application of Titanium Dioxide nanoparticles-chitosan (TiO₂-Cs) beads in photocatalytic dye reduction is limited due to the photon or mass transfer limits, oxygen defiance, and low photonic efficiency. This is caused by the non-homogenous monodispersed of the TiO₂-Cs photocatalyst. There is an increasing need to create a cost-effective and high performance of photocatalyst synthesis system. Microfluidic approach may provide a standard platform to overcome the limitations as they enable convenient control of various operating conditions during reaction such as flow rate and heat dissipation. Thus, a microfluidic device which only requires a small throughput for the repetitive testing with highly efficient photocatalyst synthesise system is proposed and simulated using Computational Fluid Dynamic Modelling. A ternary system photocatalyst, gold nanoparticles-loaded TiO₂-Cs (AuNPs-Chitosan-TiO₂) is proposed and synthesise using the proposed droplet-based microfluidic system to overcome limitation of titanium dioxide (TiO₂) which is the low photocatalytic activities in visible light. The physical properties of the photocatalysts such as interfaces, shape, and light adsorption will be characterised. Besides, computational fluid dynamics (CFD) simulation of photocatalysts droplet formation in 2-dimension cross-junction microchannels were performed using the Volume of Fluid (VOF) method. The effect of control parameters such as the contact angle, the capillary number, the interfacial tension, and the continuous phase viscosity will be investigated. The reaction kinetics and reduction mechanism of the dyes will be studied to correlate on the TiO₂-Cs and AuNPs-Chitosan-TiO₂ micro-encapsulated photocatalyst and photocatalytic performance separately. A novel design of a microfluidic chip-based photocatalyst synthesise system will be developed and optimized with improvement in efficiency and consistency toward degradation of pollutants in wastewater. It is anticipated that using microfluidic technique with a low throughput will produce a homogenous standard of TiO₂-Cs and AuNPs-Chitosan-TiO₂ photocatalyst under controlled light radiation, as well as quick iterative testing and optimization of its photocatalytic activities for dyes reduction.

Keywords: Microfluidic Chip-based Photocatalyst Synthesise, Photocatalytic-dye Reduction, Ternary System Photocatalyst, Volume of Fluid (VOF), 2D Cross-junction Microchannels.



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PARASITOID-HOST INTERACTIONS BETWEEN A DARWIN WASP AND ITS WOOD BORING BEETLE LARVAL HOST

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ABSTRACT

Xorides xylotrichi (Hymenoptera: Ichneumonidae) is a specialist parasitoid of walnut stem borer, Xylotrechus stebbingi (Coleoptera: Cerambycidae), a serious pest of walnut trees (Juglans regia) in north-western Himalayas. In the present study we exposed the infested branches to female wasps and studied different parasitoids-host interactions including host selection behaviour, envenomisation, oviposition and larval development. The results demonstrated that wasps develop as solitary parasitoids with host size having a significant effect on the sex determination of the parasitoids. The female wasps utilise specialised sensory structures to located the host for oviposition. The parasitoids were observed to produce three generations in a year and undergo pupal diapause in the month of October with subsequent emergence in may next year. The results of the present study could serve as valuable resource for the successful implementation of biological control against the walnut stem borer.

Keywords: Parasitoid, Longhorn Beetle, Kashmir Himalayas.



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MAKING A PREDICTION OF DISASTER TWEETS BY TAKING ADVANTAGE OF THE EXISTING MACHINE LEARNING MODELS

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ABSTRACT

In today's world convivial media has become an integral part of life. Twitter is an American micro-blogging and gregarious networking portal which provides the users a platform to post news, data and celebrations. Twitter has become an essential mode of communication medium during the occurrence of an emergency or disaster. The pervasiveness of perspicacious phones and tablets enable people to pronounce and apprise others of the occurrence of an emergency they are experiencing in authentic-time. This information regarding disasters propagated over the gregarious media can preserve thousands of life by alerting others so that they can take evasive action. Thanks to computer technology. texts uploaded on gregarious media may be relegated predicated on the emotional expressions they contain, making it simple to utilise them to expound and forecast occurrences. Natural language processing (NLP) implements are capable of carrying out this estimation process. In this paper, we utilized several preprocessing strategies, the TF-IDF (Term Frequency-Inverse Document Frequency) feature extraction method, and relegation models to evaluate tweets containing disaster-cognate terms. According to their fl scores. train precision, and test precision, we compared sundry relegation algorithms (SVC, MultinomialNB, LogisticR, XGBClassifier, RandomForest, DecisionTreeClassifier, and KNeighborsClassifier).

Keywords: URL, ML, Cybercrimes, Phishing, Learning.



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BONE FRACTURE DETECTION SYSTEM USING ML APPROACH

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ABSTRACT

The objective of this research is to develop and fine-tune a feasible solution for the identification and classification of various bone fractures in the medical field using Convolutional Neural Networks (CNNs) in the scope of modern models such as ResNet, DenseNet, VGG16, and so forth. The study involved performing multiple model fine-tuning attempts for various models, with a focus on achieving a predefined threshold of confidence agreed upon later in this research. The research findings revealed that the classification results were lower than the predefined threshold of confidence. However, the promising results achieved suggest that machine learning and deep learning-based solutions for identifying and classifying bone fractures could potentially replace traditional methods currently employed in the medical field with much better results. The researchers believe that further fine-tuning and the application of more advanced techniques such as Feature Extraction can help improve the accuracy of the model and increase the confidence threshold. The use of CNNs in bone fracture detection is a new approach that has shown promise in recent research. CNNs are known for their ability to learn and recognize complex patterns and features in images, making them well suited for the task of bone fracture classification. However, the development of such models requires a large dataset of labeled images that are representative of the various types of bone fractures. The use of deep learning models such as ResNet, DenseNet, and VGG16 has allowed for the development of more complex models with better accuracy in bone fracture detection. These models have shown improved performance in other areas of medical imaging, and their application in bone fracture detection holds great potential. While the use of machine learning and deep learning-based solutions in bone fracture detection is still in its early stages, the researchers believe that the potential benefits of these methods are significant. The ability to accurately and efficiently detect bone fractures can lead to better treatment planning and management, resulting in improved patient outcomes and quality of life. Furthermore, the use of machine learning-based solutions can help reduce human error in bone fracture detection and provide a more objective and consistent diagnosis. In conclusion, the use of machine learning and deep learning-based solutions for identifying and classifying bone fractures has the potential to significantly improve the accuracy and efficiency of bone fracture detection in the medical field. While further research and development are necessary, the promising results achieved in this study suggest that these methods may eventually replace traditional methods currently employed in the medical field.

Keywords: ML, ResNet, DenseNet, VGG16, CNN.



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PROPOSING NLP BASED NEWS CLASSIFICATION SYSTEM

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ABSTRACT

We are observing that electronic data is generated at a very fast pace. We in the current work are going to utilize one platform of e-content that is news. News is getting electronically circulated all around the world nowadays. In our work what we have done is made a utilization of a programming language called Python. Which is the need of the current era in terms of implementing AI features in the Application. We have made a utilization of the ML approach to get through with the Solution of the Problem posed. Natural Language Processing or NLP is the Technique of AI that is what is utilized in the Conceptual level.

Keywords: Algorithm, NLP, AI, ML, Python.



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SURVEILLANCE SYSTEM USING THE CONCEPT OF COMPUTER VISION

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ABSTRACT

Computer Vision is an Emerging area in the Field of Computer Science and Engineering. Cameras are readily available to almost all the people around the globe. The current work is aimed at making the best usage of the available tools and models to solve the problem of theft happening every now and then in almost all the areas. We are in our work devising a system that is going to help is creating an alarm. The work is implemented in Python and makes usage of the best of the Algorithms available for the purpose. We are able to have a very nice accuracy measure in our work. ML is the path finder. We have made a good use of the AI material to go through with the problem addressed.

Keywords: Algorithm, Computer Vision, AI, ML, Python.



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FLUORINATED CARBON NANOHORNS – BASED NANOCOMPOSITE AS SENSING LAYER FOR RESISTIVE NITROGEN DIOXIDE SENSOR

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ABSTRACT

This paper reports the development of resistive nitrogen dioxide sensor, employing a sensing layer based on a binary matrix nanocomposite comprising fluorinated carbon nanohorns (CNHs-F) and reduced graphene oxide (rGO). The sensing device consists of a metallic interdigitated dual-comb structure fabricated on a Kapton substrate the electrodes being made of gold. The width of the electrodes is about 200 microns, with a separation of 6 mm between them. They can be linear or have an interdigitated configuration. The NO₂ monitoring capability is investigated by applying a constant current between the two electrodes and measuring the voltage at different values of the NO₂ concentration to which the sensing layer is exposed. From the point of view of the detection principle, the resistance of the sensitive layer varies with the NO₂ concentration level. The interaction of NO₂ molecules with rGO and CNHs-F can be interpreted from the perspective of the HSAB theory. Both fluorinated carbon nanohorns and reduced graphene oxide. They are p-type semiconductors, conduction mainly through holes. When the sensitive layer is exposed, the physisorbed and chemisorbed molecules of NO₂ (oxidizing gas) will act as electron acceptors, increasing the concentration of holes in both nanocarbonic material and thus leading to a decrease in resistance. Fluorinated carbon nanohorns and reduced graphene oxide give a high specific surface / volume ratio, as well as a variation in the resistance of the sensitive layer upon contact with NO₂ molecules. The new synthesized sensing layer has several significant advantages: detection at room temperature, chemical and thermal stability, superior mechanical properties.

Keywords: Nitrogen Dioxide, Carbon Nanohorns, HSAB, Reduced Graphene Oxide.



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NOVEL RESISTIVE RELATIVE HUMIDITY SENSOR

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ABSTRACT

This paper reports the design and manufacturing processes for a resistive relative humidity sensor, employing a sensing layer based on oxidized carbon nanohorns (SWCNHs)–fullerenol – poly (acrylamide-co-acrylic acid) partial sodium salt ($M_w = 520,000$) ternary nanocomposite.

The interdigitated (IDT) sensing structure was manufactured on a Si substrate ($470 \mu\text{m}$ thickness), covered by a SiO_2 layer ($1 \mu\text{m}$ thickness). The metal stripes of IDT comprised a Cr (10 nm thickness) and Au (100 nm thickness) stack, having $200 \mu\text{m}$ width. 6 mm was the distance between the electrodes. The RH detection capability of the structure was investigated by applying a current between two electrodes and measuring the resistance of the IDT, at different RH levels. The use of the ternary nanocomposite oxidised carbon nanohorns/fullerenol/poly (acrylamide-co-acrylic acid) partial sodium salt will provide a series of significant advantages and enhancements, in comparison with other chemoresistive humidity sensors: a. a high ratio between specific surface and volume. b. a very good detection over a wide range of temperature; c. the hydrophilic character of the sensitive layer can be easily modulated based on the oxidation parameters specific to the method employed (plasma power, nitric acid concentration, reflux time, etc.); d. fullerenol has a pronounced antioxidant character, hydrophilic properties, good compatibility with oxidized carbon nanohorns; Poly (acrylamide-co-acrylic acid) - partial sodium salt, is a hydrophilic polymer that ensures the cohesion of the two nanocarbon materials, being an excellent binder.

Keywords: Oxidized Carbon Nanohorns, Fullerenol, Resistive Humidity Sensor.



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POLYANILINE – BASED MATRIX NANOCOMPOSITE AS SENSING LAYER FOR RESISTIVE HUMIDITY SENSOR

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ABSTRACT

This paper reports the design and manufacturing process for a new chemiresistive humidity sensor using conductive polyaniline- polyvinylpyrrolidone nanofibers as sensing layer. The RH sensor includes a dielectric substrate, a first electrode and a second electrode disposed above a dielectric substrate and the sensing layer. The electrodes (aluminum, copper, and chromium) are deposited onto the surface of the dielectric substrate through direct printing. Synthesis of conducting polyanilines is performed through doping of emeraldine with Calmagite and sulfonated polyethylene glycol (PEG-SO₃H). The synthesized nanocomposite is deposited onto interdigitated electrodes through drop casting method. These sensing films exhibit some important advantages: -Calmagite contains sulphonic groups that are strong acids according to the Bronsted-Lowry theory and can protonate imine nitrogen atoms in the emeraldine structure with the formation of stable conductive polyaniline; -Due to the large size counter-ion, the polyanilines doped with Calmagite and PEG-SO₃H and are less susceptible to the de-doping; -Due to aromatic skeleton, Calmagite interacts with emeraldine through the π - π stacking interaction, resulting in a more stable structure; - Polyvinylpyrrolidone is hygroscopic, improves the mechanical and film properties of polyaniline; -The synthesis of PEG-SO₃H is facile, from versatile precursors; -PANIs are polymers with good environmental stability, low cost and mature fabrication process. The conductive nanocomposite based sensing layer were investigated by applying a voltage between the two electrodes and measuring the electrical current flowing through the sensitive layer at various levels of humidity.

Keywords: Chemiresistive Humidity Sensor, Polyaniline- Polyvinylpyrrolidone Nanofibers.



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NOVEL RESISTIVE SENSOR FOR INDOOR FORMALDEHYDE POLLUTION

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ABSTRACT

Formaldehyde is a flammable, colorless gas with a pungent odor. In the indoor environment the most significant sources of formaldehyde are urea-formaldehyde resin and tobacco smoke. It is associated with many health risk factors and has been identified as a major cause of Sick Building Syndrome (SBS). Therefore, in the last years, different types of sensors were developed for monitoring indoor formaldehyde level. This paper reports the development of chemiresistive formaldehyde sensor, employing a sensing layer based on a nanohybrid comprising N- doped carbon nano onions – polyvinylpyrrolidone. The mass percentage of nanocarbonic component in the sensing film varies between 80 and 90. The sensing device consists of a metallic interdigitated dual-comb structure fabricated from Si/SiO₂, the electrodes being made of gold. They can be linear or have an interdigitated configuration. The formaldehyde monitoring capability is investigated by applying a constant current between the two electrodes and measuring the voltage at different values of the formaldehyde concentration to which the sensing layer is exposed. The decrease in conductivity is explained by the fact that coulombian interaction between formaldehyde and N- doped carbon- nanonions disrupts the percolation channels. The new sensing layer has several significant advantages: - N- doped carbon nano-onions ensure a high specific surface / volume ratio, as well as a variation in the resistance of the sensitive layer; - polyvinylpyrrolidone is an effective dispersant for nitrogen-doped onion-type nanocarbon materials; - detection at room temperature; - chemical and thermal stability.

Keywords: N-doped Carbon Nano-Onions, Formaldehyde, Resistive Sensors.



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NOVEL SENSOR FOR RELATIVE HUMIDITY HOME MONITORING

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ABSTRACT

The interest for reliable, low-energy consumption and highly sensitive relative humidity sensors increased in the last years due to their usefulness in a wide variety of industrial, commercial, and residential applications such as in HVAC (heating, ventilation, and air conditioning). This paper reports the development of resistive relative humidity sensor, employing a sensing layer based on a fluorinated carbon nanohorns, fluorinated carbon nano-onions and as well as nanocomposites of the type fluorinated carbon nanohorns-fluorinated carbon nano-onions. The RH sensor includes a PET substrate, interdigitated electrodes and a sensing layer obtained via drop casting method. The RH monitoring capability of the sensing layers was investigated by applying a current between the two electrodes and measuring the voltage at different values of relative humidity at which the sensing layer was exposed. The new synthesized sensing layer used in the manufacturing of resistive RH sensor have several significant advantages: -both nanocarbonic materials ensure a high specific surface / volume ratio, as well as a variation in the resistance of the sensing film in contact to water molecules; - fluorine atoms, through the electron-attracting effect, increase the number of carriers both in carbon nanohorns and in onion-type nanocarbon materials. As in both nanocarbonic structures conduction is achieved through holes, the material's sensitivity to water molecules increases; - the presence of fluorine atoms reduces the hysteresis through their hydrophobic effect; - detection at room temperature; - chemical and thermal stability; - superior mechanical properties.

Keywords: Relative Humidity, Fluorine, Carbon Nanohorns, Sensor.



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THE KEY ISSUE ASPECTS RELATED OF ACTION
AND OUTLOOK OF USE MONOCLONAL
ANTIBODIES IN MISCELLANEOUS
IMMUNOTHERAPEUTIC DIRECTIONS

- Nodar Sulashvili
- Nana Gorgaslidze
- Luiza Gabunia
- Nato Alavidze
- Marika Sulashvili

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AN EXPERIMENTAL STUDY TO IMPROVE THE MATRIX OF THE EARTHEN MATERIALS

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ABSTRACT

Earthen materials have been used since ancient times. Their use in construction has decreased with the development of building materials technology after the Industrial Revolution. Nowadays, earthen materials gain importance as building material that reduces embodied energy and promotes sustainability. They have disadvantages such as low compressive strength and high sensitivity to moisture. To overcome these, the researchers use stabilizers such as lime, cement, fiber, or bitumen. This study focused on natural hydraulic lime (NHL3.5), which there is limited research using as a stabilizer. Two different soils were taken from Elbeyli region, which has many earthen structures in İznik district of Bursa. First of all, the characterization tests of the soil types were conducted in order to determine the appropriate type. As characterization tests, acid and ignition loss analyses, sieve analysis, and XRD analysis were conducted. NHL 3.5 and air lime were used to stabilize the matrix. Two ratios of 6% and 12% binders and two curing conditions, curing cabinet with (23±2 C - >90% RH) because of using a hydraulic binder and laboratory condition (23±2 °C - 40±10% RH), were investigated. As a result, samples were not disintegrated in water except samples of 6% air lime additives and the control group. The samples containing additives for all curing conditions have better resistance to water except containing 6% NHL 3.5. Air lime additives increased the strength of the samples, while NHL 3.5 decreased slightly. Also, it is seen that the curing cabinet curing decreased the strength of all samples in comparison with laboratory condition curing.

Keywords: Earthen Material, Earthen Block, Stabilization, Natural Hydraulic Lime, Air Lime.

1. INTRODUCTION

Earthen building materials are ancient building materials commonly found in Europe, Asia, Australia, and Africa for centuries. The oldest examples date back to 2000 BC. One of the most critical features of earth-building materials is the use of locally available raw earth in its natural state, thereby reducing the carbon footprint produced compared to other traditional building materials. Despite all these benefits, earthen building materials were used due to limited



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technological possibilities and regional raw material supply difficulties before the industrial revolution. For this reason, it has been seen as a material that should be abandoned as the welfare level of society increases with the developing technology (Araki et al., 2011; Abhilash, et al., 2022; Kafescioğlu & Gürdal, 1985).

Today, energy consumption is one of the most critical problems in the world. The construction sector has a significant share in environmental damage, consuming more than 40% of the total energy produced globally and emitting more than 30% CO₂ (Directive 2010). The energy spent in the production processes of modern construction materials creates waste after the end of their useful life, the resources used are limited, and the circular economy is negatively affected by the high transportation costs from the factories to the construction site (Boucheфра et al., 2022; Labiad et al., 2022). In recent years, the use of earth as a building material has attracted attention primarily due to its low environmental impact throughout its life cycle. Research shows that using these environmentally friendly materials in the construction industry helps conserve natural resources, reduces pollutant emissions, and increases energy recovery. In addition to being environmentally friendly, they are easy to use, recyclable, regulate indoor humidity and improve the thermal comfort of buildings, leading to their reuse. [(Boucheфра et al., 2022; Labiad et al., 2022; Meddah et al., 2020; Meddah et al., 2020). Various earth construction techniques exist in different parts of the world, such as adobe, mud, earth straw, and compacted earth blocks. Compressed earth blocks are a new method developed to obtain blocks with sufficient mechanical performance by eliminating voids and increasing density. Despite the high compression, high water absorption and crack formation are disadvantages of earthen. To overcome these, scientists recommend using many stabilizers such as lime, cement, fiber, and bitumen [Labiad et al., 2022; Sindanne et al., 2014; Tatane et al., 2018; Meddah et al., 2017).

Soil has been used as a building material since ancient civilizations. On the other hand, Anatolia is among the regions where the early soil structure can be preserved. Çatalhöyük, with its adjoining adobe houses with wooden beams, is a rare example of Neolithic adobe use. The city of Hattusha is an example that reveals the mud brick urban texture. In addition to these, samples of earthen building materials are also seen in critical old settlements such as Aşıklıhöyük, İznik Ilıpınar, Acemköyük, Aslanteppe, Çayönü, Alacahöyük, and Alişar (Kafescioğlu, 2017). Rural settlements have a local and original character with their historical, natural, and cultural structures. New structures are built commonly, or soil architectural heritage items are neglected, abandoned, destroyed, or demolished because the local people do not know the proper maintenance methods for traditional architectural systems. Thus, it reveals the risk of losing the rural heritage that societies have shaped with centuries of accumulation and causes concerns about the survival of these settlements and their transfer to the future. Iznik, on the UNESCO World Heritage tentative list and whose candidacy continues, is a multi-layered cultural center hosting many different civilizations. Iznik is a multi-layered cultural center hosting many different civilizations. Ömerli and İnikli villages are largely preserved settlements that reflect the cultural characteristics of the region. Most of these settlements were built with earth-based materials and traditional adobe architectural construction techniques. Bozyel (2019) researched the protected area of Ömerli village in his master's thesis (Bozyel, 2019). His study determined that 67% of the building stock in there consists of mudbrick structures. Earthen building samples found in the region are given in Figure 1.

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Figure 1. a) General view of Ömerli village, b and c) examples of traditional Turkish houses in the village; mud-brick-filled straw structures (Bozyel, 2019)

Seco et al. (2017) determined that the sand content of compressed earth blocks does not have a relationship with their mechanical resistance, which clearly depends on the type of used additive (Seco et al., 2017). 10% NHL 5 additives gave 4.2 times higher compressive strength than the lowest reference value of relevant Spanish Standard. Mkaouar et al. (2019) stabilized compressed earth blocks using several ratios of lime (Mkaouar et al., 2019). It was found that it reached the highest strength by adding 10% of lime. Samples with 10% lime additives have 3.8 times higher compressive strength than control samples. Miqueleiz et al. (2012) used commercial stabilizers such as NHL 5 and CL-90-S to produce stabilized unfired soil clay bricks Miqueleiz et al. (2012) When the CL-90-S additive dosage limit exceeds 6-9%, there is no effect of adding more additives. However, the strength of samples with NHL 5 additives increased when NHL 5 dosage was increased. Barbero-Barrera et al. (2020) investigated the stabilization of compressed earth blocks with NHL 2 and NHL 3.5 additives (Barbero-Barrera et al., 2020). The results showed mechanical strength increased when NHL 2 and NHL 3.5 additives increased. However, mechanical performance dropped higher dosages when NHL 3.5 dosage exceeded 6% due to the low relative humidity curing conditions (Table 1).

Table 1. Summary of studies in the literature.

Additives	Curing conditions	Results	References
4%, 6%, 8%, 10 % Lime	28 Days in drying oven at 60 °C	It reached the highest strength by adding an optimum quantity (10%) of lime. Lime addition reduced the ability of compressed earth to absorb water and the density increased	Mkaouar et al., 2019
3%, 6%, 9%, 12% NHL2- NHL3.5	28 days curing at room temperature (20°C and 50% RH)	The results showed mechanical strength increased when NHL 2 and NHL 3.5 additives increased. However, mechanical performance dropped higher dosages when NHL 3.5 dosage exceeded 6% due to the low relative humidity curing conditions.	Barbero-Barrera et al., 2020.
3%, 6%, 9%, 12%, 15%, 18% NHL5 Calcareous hydrated	1, 7, 28, 56 and 90 days in moisture chamber covered with polythene sheeting to prevent further moisture loss	Samples with NHL 5 additive have better strength than samples with CL-90-S additive.	Miqueleiz et al., 2012



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Lime (CL-90-S)

10% NHL5

28 Days at 20°C and 100% RH

The sand content of samples does not have a relationship with their mechanical resistance, which clearly depends on the type of used additive. NHL5 got values between 4.4 and 5.5 MPa which overcomes 1.3 MPa, the lowest reference value allowed in the Spanish Standard

Seco et al., 2017

This study analyzed soils belonging to the Elbeyli region, located in the Iznik district of Bursa. Then the soils were separated from the residues and sieved. Earthen blocks were prepared with the soil selected in the preliminary study. Natural hydraulic binders (NHL3.5) and air lime were investigated to stabilize the earthen blocks. The aim of this study is that improve the matrix of the earthen materials by adding sustainable additives such as air lime and natural hydraulic lime. Thus, it is aimed to increase the water resistance of the earthen material, which is sensitive to water, and to increase its mechanical performance.

2. MATERIALS and METHODS

This study evaluates the use of lime-based binders to increase the matrix performance in earthen materials. The experimental study consists of two parts. The first part is about to characterize soil. The second part consists of the production, curing, and physical and mechanical tests of earthen blocks. For the research, earthen samples were prepared with additives, moderately natural hydraulic lime (NHL 3.5), and air lime (Figure 2).

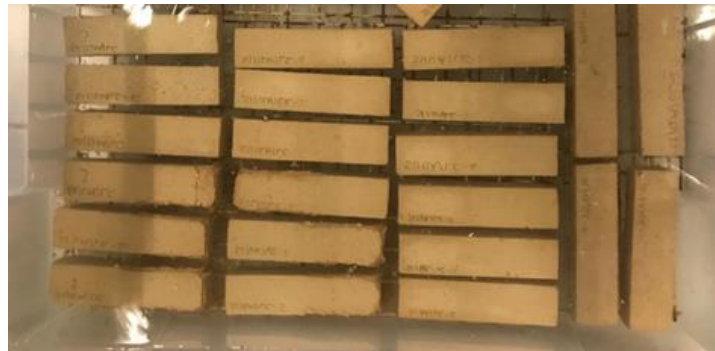


Figure 2. Earthen samples.

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Two ratios of binders, 6% and 12%, and two curing conditions, curing cabinet with (23 ± 2 °C and $>90\%$ RH) and laboratory condition (23 ± 2 °C and $40\pm 10\%$ RH), were investigated. A curing cabin was used to determine whether the hydraulic additive would increase the effect on the mixture compared to curing under laboratory conditions. The samples cured in the curing cabinet were kept in laboratory conditions a day before the test. Experimental workflow is given the Figure 3.

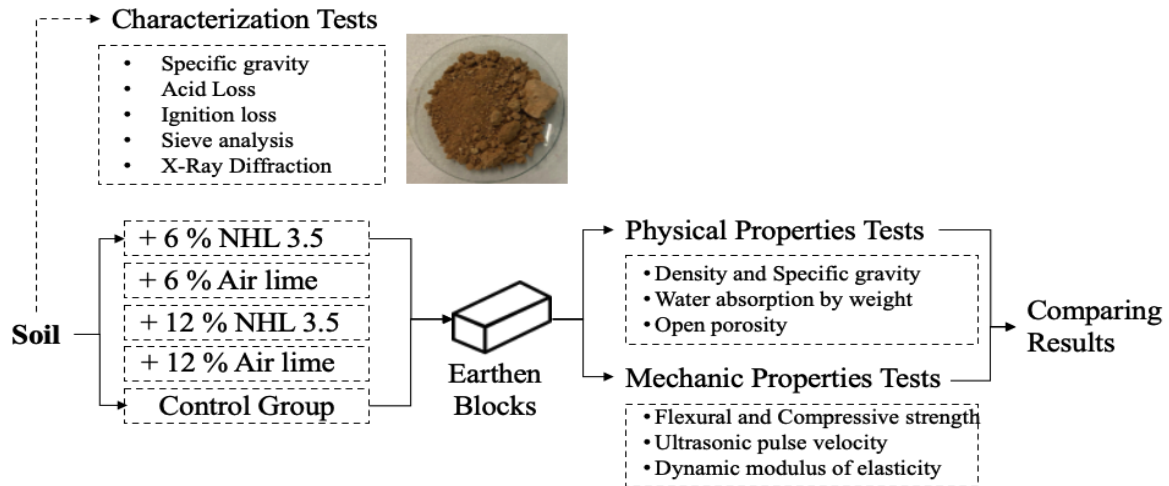


Figure 3. Experimental workflow in the present study.

2.1. Materials

The soil used in this study was obtained from the Elbeyli region, located within the borders of the Iznik district of Bursa province (Figure 4). The soil has been tested for specific gravity, chemical analyses (acid loss and ignition loss) and sieve analysis. In addition, X-ray diffraction analysis was made for the mineralogical composition of the soil.

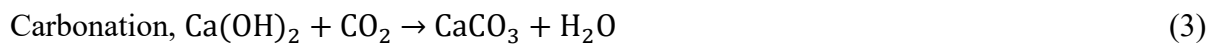


Figure 4. The soils used in this study that obtained from the Elbeyli region.

Moderately natural hydraulic lime (NHL 3.5) and air lime were used to stabilize earthen blocks. NHL 3.5 is a cement-free binder material with high water vapor permeability, providing breathability. This binder has benefits such as being economical, low energy consumption, and low CO₂ emission during production (Lubelli et al., 2011). Natural hydraulic lime was used in

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historical mortars. In addition, it is preferred for repair works and in cases where early strengthening is required (Lanas et al., 2004). The raw material of hydraulic lime usually consists of calcium carbonate (CaCO_3), silica (SiO_2), clay minerals (hydrated aluminosilicates), and iron oxide (Fe_2O_3). The raw material is calcinated at low temperatures, approximately $900\text{ }^\circ\text{C}$. Then, the clinker is slaked. The main hydraulic phase is C_2S (dicalcium silicate, Belite) for natural hydraulic lime [20]. Air lime is produced by calcining of limestone (CaCO_3 or $\text{CaMg}(\text{CO}_2)_2$) at approximately $900\text{ }^\circ\text{C}$ (1) and slaked with water (2). Air lime becomes carbonated by hardening with air (3). Natural hydraulic lime and air lime used in this study were commercial products.



2.2. Production of Earthen Blocks and Curing

The manufacturing process of earthen blocks involves several steps, including removing roots and leaves residues, drying, sieving, and mixing with binder and water by hand. Once the mixture was ready, it was placed in a mold and compacted by hand to form $40 \times 40 \times 160\text{ mm}$ samples (Figure 5).

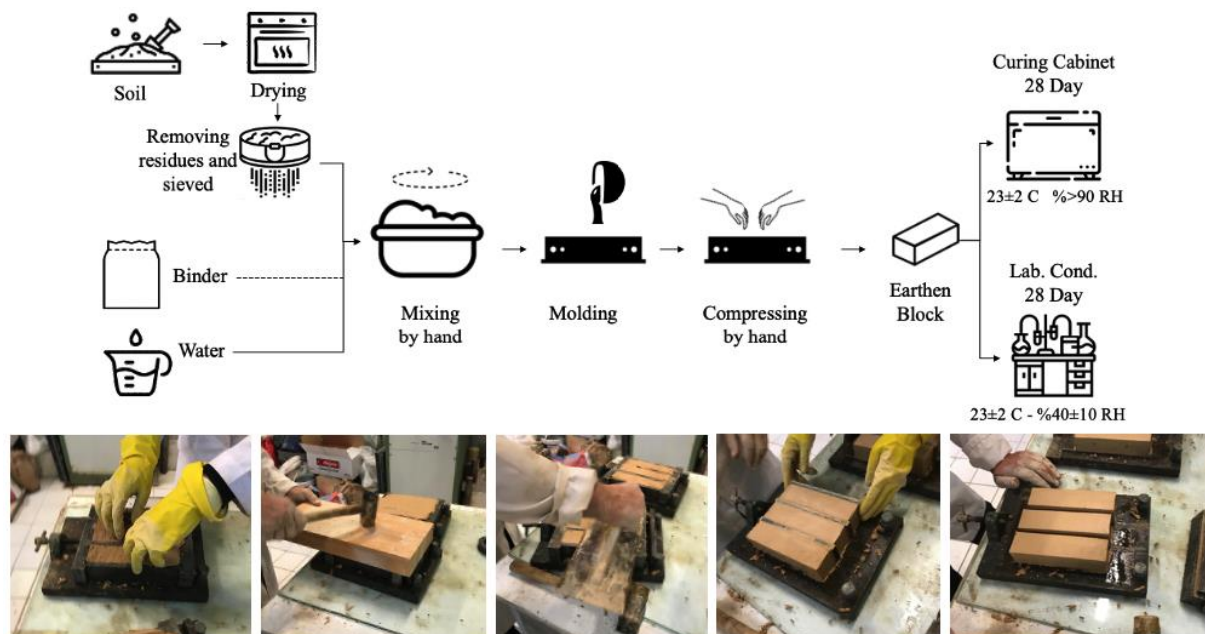


Figure 5. Production process of earthen samples.

The control group was produced using only soil and water. Samples were subjected to two different curing conditions for 28 days in the curing cabinet with ($23 \pm 2\text{ }^\circ\text{C}$ and $>90\% \text{ RH}$) and laboratory conditions ($23 \pm 2\text{ }^\circ\text{C}$ and $40 \pm 10\% \text{ RH}$). Sample codes, mixing ratios of ingredients by dry weight, and curing conditions are shown in Table 2.



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Table 2. Sample codes, mixing ratios of ingredients by dry weight, and curing conditions.

Sample Codes	Soil (gr)	Additive (gr)		Additive ratio by dry soil mass (%)	Water (gr)	Water/ Additive ratio (%)	Water/ Total mass ratio (%)	dry Cure Conditions
		NHL 3.5	Air Lime					
S/6N/LC	1200	72	-	6	312	4.33	0.25	Lab.Cond.
S/6N/CC	1200	72	-	6	312	4.33	0.25	Cur. Cabinet
S/12N/LC	1200	144	-	12	348	2.42	0.26	Lab. Cond.
S/12N/CC	1200	144	-	12	348	2.42	0.26	Cur. Cabinet
S/6A/LC	1200	-	72	6	343	4.76	0.27	Lab. Cond.
S/6A/CC	1200	-	72	6	343	4.76	0.27	Cur. Cabinet
S/12A/LC	1200	-	144	12	390	2.71	0.29	Lab.Cond.
S/12A/CC	1200	-	144	12	390	2.71	0.29	Cur. Cabinet
S/C/LC	1255	-	-	-	291	-	0.23	Lab.Cond.
S/C/CC	1255	-	-	-	291	-	0.23	Cur. Cabinet

S: Soil, N: NHL3.5, A: Air Lime, S/C: Control Group, LC: Laboratory conditions, CC: Curing Cabinet

3. RESULTS

The results of the study were examined under two separate headings which are soil characterization tests and tests on stabilized earthen blocks.

3.1. Soil Characterization Tests

Soil taken from Elbeyli contains 75-80% Calcite, <5% Quartz, 15-20% Smectite, <5% Chlorite-Kaolinite, <5% Britholite according to the X-ray diffraction analysis (Figure 6).

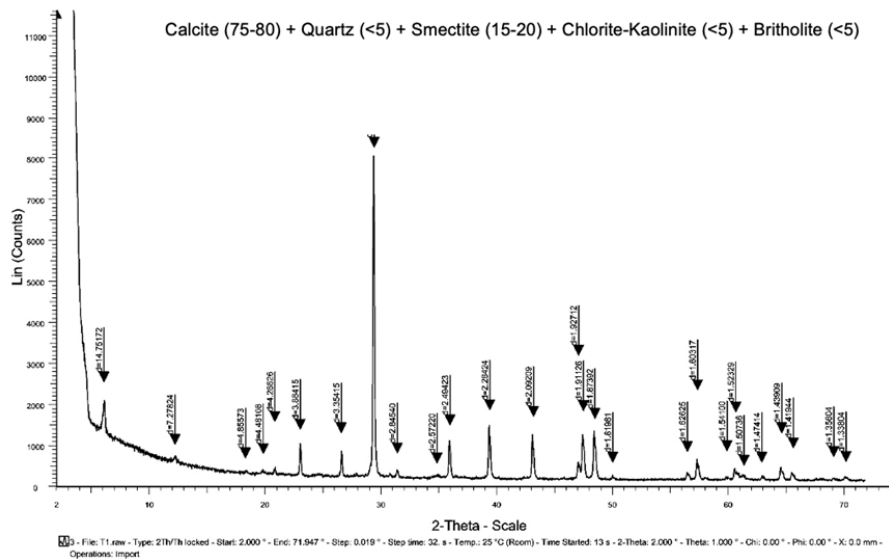


Figure 6. X-ray diffraction pattern of soil.

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Specific gravity, acid loss, and ignition loss of soil are 2.57 gr/cm^3 , 72%, and 33% respectively. The amount of oven-dry soil was weighed and added to a beaker. Then water was added, washed, and filtered to remove clay. Sieve analysis was performed on the aggregates remaining in the beaker. Sieve analysis is given Figure 7.

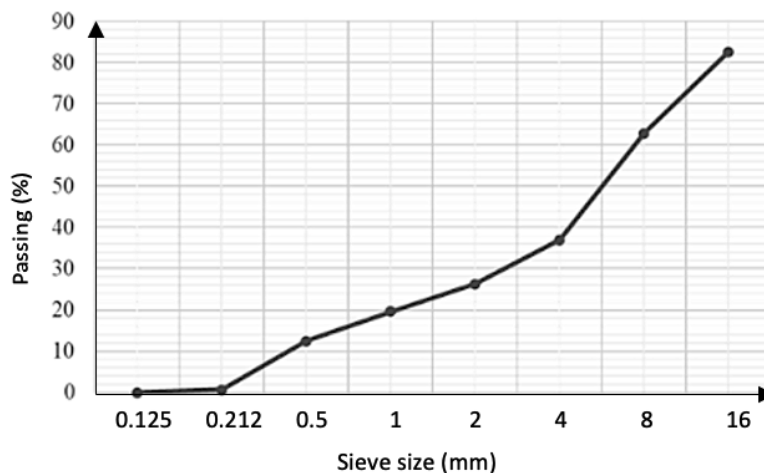


Figure 7. Sieve analysis of soil.

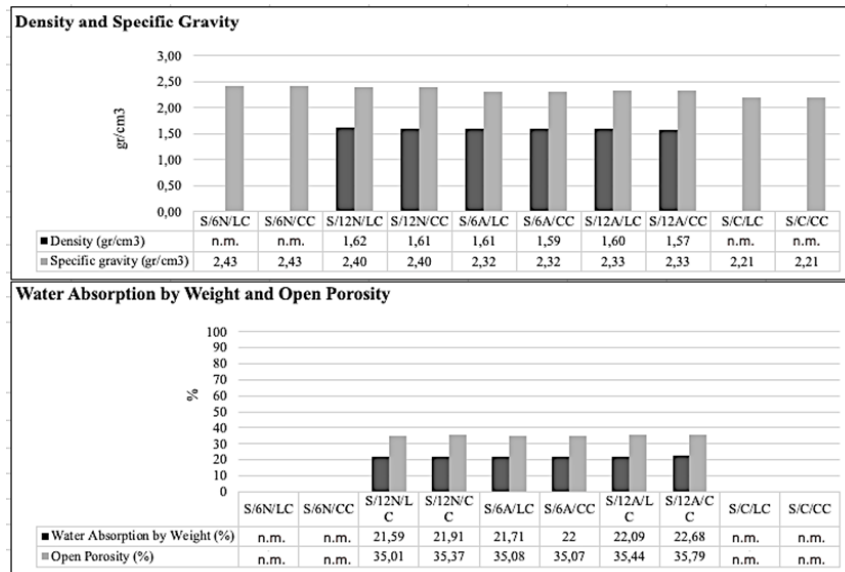
Before the soil samples were prepared, a minimum amount of water that provided suitable consistency was determined. For this, 150 g of soil in oven dry was taken into a container. Then, water was added and controlled, and paste of suitable consistency was prepared. The amount of water added was noted when it reached the consistency ideal for compaction by hand ramming. A stiff and non-sticky paste was taken care of to determine the minimum amount of water. The minimum mixing water ratio was 23%.

3.2. Stabilized Earthen Blocks

Experiments were carried out to determine the density, specific gravity, water absorption under atmospheric pressure, and open porosity according to TS EN 1936 (TSE Standards Publications, 2007). It was determined flexural strength and compressive strength according to BS EN 196-1 (BSI Standards Publications, 2016) ultrasound velocity according to TS EN 14579 (TSE Standards Publications, 2006). and dynamic elasticity module according to TS EN 14146 (TSE Standards Publications, 2014). Water is one of the most destructive factors for earthen-based materials that are not burning at high temperatures. Therefore, it is very important to increase the resistance to water while improving the mechanical properties of the earthen material.

When lime-based additives are added in the mixture the pH value is up to about 12.4 because of the presence of OH^- ions from the lime. The high pH of the mixture causes pozzolanic reactions between the Si and Al that form part of the clay matrix and the available Ca^{2+} from lime. Pozzolanic reactions provide that occur Calcium Silicate Hydrate (C-S-H) and Calcium Aluminate Hydrates (C-A-H) gels that are responsible for improving the mechanical and physical properties of earthen blocks [16]. The physical test results are given in Figure 8.

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n.d. = not measured

Figure 8. Physical tests results.

Physical property determination experiments could not be completed because samples containing 6% NHL 3.5 and samples (S/6N/LC and S/6N/CC) belonging to the control group (S/C/LC and S/C/CC) without binder dispersed when exposed to water. Among the samples that can be evaluated, it is seen that the sample with the lowest water absorption rate belongs to the mixture containing 12% NHL 3.5 and curing laboratory conditions. The mechanical tests results are given in Figure 9.

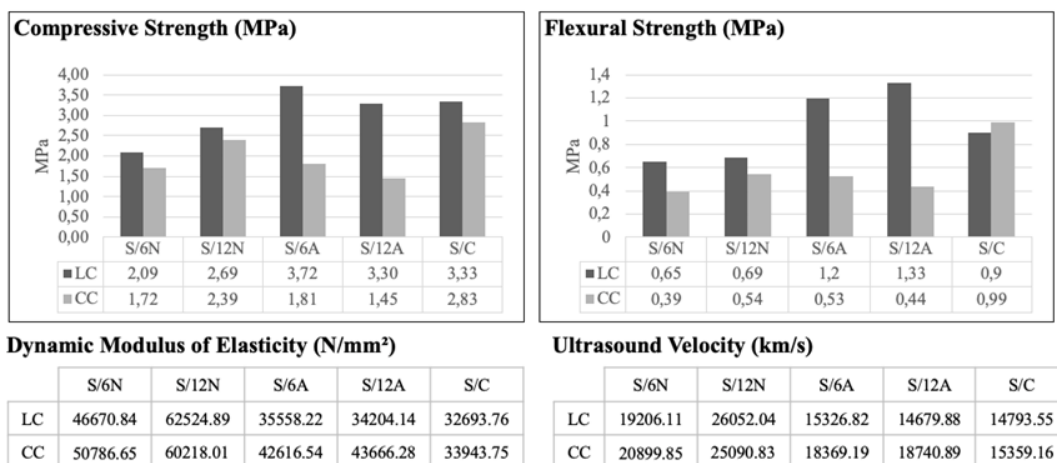


Figure 9. Mechanical tests result.

According to the results, the matrix, which is aimed to be developed by adding NHL 3.5, shows weak characteristics compared to the control group in mechanical aspects. While the samples containing 6% and 12% air lime were more durable than the control group in both compressive strength and flexural strength, however, this only applies to specimens cured in laboratory conditions. The data obtained as a result of both evaluations of the samples cured in the curing cabinet is lower than the control group.



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4. CONCLUSION and SUGGESTIONS

This study, which is a preliminary study, gives an idea in terms of developing the matrix in the earthen building materials. The traditional soil materials disperse in water. Increasing water resistance is critical. Samples with 6 and 12% air lime and 12% NHL3.5 additives were not dispersed in water. Additives increased the water resistance of the samples. Samples with 6 and 12% air lime and 12% NHL 3.5 additives had quite similar water absorption rates. Samples with 6% air lime (S/6A) additive had the highest compressive strength. Properties are affected by curing conditions. It is seen that samples that were cured in the curing cabinet had lower mechanical strength than samples that were cured in laboratory conditions. However, samples containing NHL 3.5 were not significantly affected by the curing conditions. It is thought that the samples coming out of the curing cabinet were tested without losing enough moisture. Long-term (3 and 6-month ages) tests need to be carried out to understand the effects of additives better because the pozzolanic reactions in the mixture continue to occur over time. It can be improved physical and mechanical properties by adding different additives and/or fibers in earthen blocks. Also, it is suggested that oven curing is tested to simulate sun drying.

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**EXPERIMENTAL STUDY ON THE PRODUCTION OF MYCELIUM-BASED
BIOCOMPOSITES**

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ABSTRACT

*In recent years, the construction industry has become more aware of the adverse impact of particular materials on the environment and human health. This has led to a growing trend towards using bio-based products that align with circular economy and sustainability principles. In addition, there has been a push towards extending the lifespan of construction materials and promoting recyclable options to reduce post-use waste and carbon emissions. Despite the widespread use of synthetic polymers in construction, these materials are known to cause harm to the environment and resource scarcity. As a promising alternative solution, biopolymers have emerged, with mycelium-based composites (MBC) being a particularly innovative and naturally sourced material that can be used in construction. While there has been a growing interest in MBC within academic studies, more information regarding production processes is often needed. Therefore, this study aims to determine the production procedure for MBC by testing specific mixing ratios and production procedures for MBCs, which do not have a standard production procedure, in light of the information in the literature. After determining the mixing ratio and production procedure, MBCs were produced by growing *Pleurotus ostreatus* on different substrates. Basic physical and mechanical properties determination tests were applied to the produced samples. As a result, the standard production procedure and mixing ratios were determined, and the effect of the substrate on the composite was revealed.*

Keywords: Biopolymers, Mycelium-Based Composites, *Pleurotus Ostreatus*, Sustainability, Innovative Building Materials.

1. INTRODUCTION

The consumption of natural resources and the accumulation of waste by plastics produced from petroleum based sources cause a global environmental crisis. The construction sector has an important share in this crisis. According to the report prepared by the United Nations, 38% of



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global CO₂ emissions from energy consumption originate from the construction sector. The main reason for these environmental problems is that the production of the material to be used, which is from the cradle to the grave, is taken from the natural source, processed, and released directly to the ecosystem after being used. Instead, by adopting a circular economy model, the waste of a material that has completed its useful life should be transformed into the substrate of another process, and the waste should be disposed of and reused (Udayanga & Miriyagalla, 2021; Mohseni et al., 2023). In this context, the construction sector should reduce the production of non-renewable building materials and achieve sustainable practices and circular economy targets by making significant changes. For this reason, cooperation in biotechnology and building materials gains importance for sustainable material production (Girometta et al., 2019).

In recent years, it has been seen that it is possible to create alternative materials to petroleum based resources used in the construction industry with mycelium-based composites (MBC) (Ghazvinian et al., 2019; Maximino et al., 2020). Fungi are microorganisms that have vital roles as important decomposers in natural ecosystems, in addition to their industrial, food, and medicinal applications (Blackwell, 2011; Hyde et al., 2019). The mycelium consists of fibrous filaments called hyphae, which can be defined as elongated cells, mainly composed of chitin, glucan, and proteins Attias et al., 2020; Etinosa et al., 2019; Haneef et al., 2017). The hyphae have a filamentous appearance. Hyphae spread throughout the substratum or an artificial medium represent the main component of fungal biomass, which absorbs the nutrients necessary to grow a fungus's mycelium. The unique structure and composition of its mycelium have made it a suitable source of natural composite materials with adjustable and well-ordered structural and mechanical properties. This biomaterial or composite is grown rather than fabricated (Udayanga & Miriyagalla, 2021; Maximino et al., 2020). It acts as a natural binder by feeding with any organic substrate around it to form an ultra dense filament network (Elkhateeb & Daba, 2019; Heisel et al., 2017). These materials, produced from mycelium, have several important advantages over traditional synthetic materials, including low cost, low density, environmentally friendly nature, and energy consumption (Jones et al., 2020; Zou & Gao, 2020).

All these advantages increase the interest in studies on MBCs. However, although there are various academic studies on its production, there is no standard production procedure and more information is needed about the production processes. Therefore, this study aims to determine the production procedure for MBCs by testing specific mixing ratios and production procedures for MBCs that do not have a standard production method in the light of the information in the literature. After the mixing ratio and production procedure were determined, MBCs were produced by growing *Pleurotus ostreatus* on different substrates. Basic physical and mechanical properties determination tests were applied to the produced samples. As a result, the standard production procedure and mixing ratios were determined and the effect of the substrate on the composite was revealed.

2. MATERIALS and METHODS

In this study, which was carried out to determine the production of MBCs and its use in buildings, first of all, preliminary tests were started based on the information obtained as a result of the literature review in order to determine the mixing ratios and production conditions to be used in the production of MBCs which do not have a certain standard. As a result of the



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preliminary tests, the first mixture ratio to be used and the required growth time for the sample were determined. Then, MBCs were produced with various substrates in the determined ratios and conditions, and some physical-mechanical property tests were carried out on these samples.

2.1.Determination of Mixing Ratio and Incubation Time

This study used *Pleurotus ostreatus*, which was previously inoculated with oat bran and stored in the freezer. The mycelium was purchased from a specialist firm. *Pleurotus ostreatus* and straw were prepared with the mixture ratios of two different studies, and all other stages related to the production processes were kept constant. Thus, it is aimed to observe the effect of mixing ratios on composite formation. Information on the reference studies and mixing ratios are shown in Table 1. As a result of the relevant production stages, mycelium growth in the prepared samples with the prepared mixture ratios was examined in 7-day periods. As a result of the observations, while no mycelium growth was observed in the experiment with mixing ratio number 1, it was observed that the mycelium growth in mixture number 2 increased gradually as a result of 7-day periods.

Table 3. Mycelium composite mixing ratios of reference studies.

No	Mycelium	Raw Material	Reference
1	50	200	15
2	100	200	16

Table 2 shows the growth observation of samples with different mixing ratios. As a result of these observations, it was decided to continue the studies based on the mixing ratios of experiment number 2.

Table 4. Growth observation of samples with different mixing ratios.

Day/No	1	2
14		
21		
28		
35		



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The literature has various information about the incubation time required for MBC formation. In order to determine an incubation period, the relevant physical and mechanical property tests were performed on the samples with 14, 21, 28, and 35 days incubation times. Information on the tests performed, and the standards used are given in Table 3.

Table 5. Tests and standards used.

Test	Standard
Water Absorption Under Atmospheric Pressure	BS EN 1936
Flexural Strength	BS EN 196-1
Compressive Strength	BS EN 196-1

The data obtained as a result of the experiments are given in Figure 1.

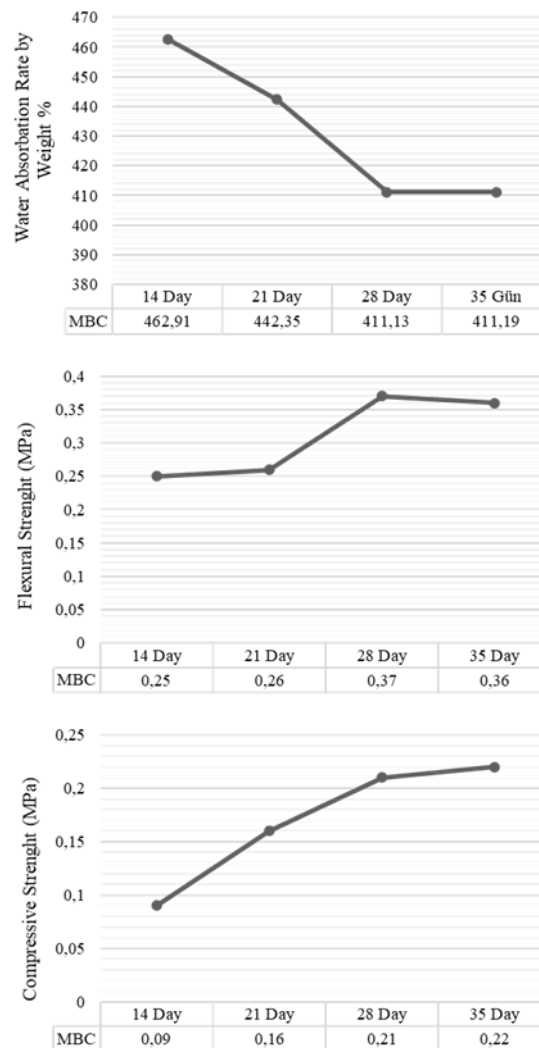


Figure 5. Test results.

Based on experimental data, it was found that samples aged 28 days and 35 days had similar characteristics. Notably, the mycelium growth in the 28-days samples covered the surface,



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indicating that growth had reached completion. As a result, it was determined that the ideal incubation period for MBCs for future studies should be 28 days.

2.2. Preparation of Composites With Various Contents

Pleurotus ostreatus was mixed with 16 different substrates using the ratio and incubation time determined as a result of the preliminary studies. Investigations were made to determine the most efficient mixture component. Within the scope of this research, rice husk, straw, rice husk powder, beech shavings, walnut shell, oat, coconut shell, hemp fiber, banana peel, banana tree fiber, textile waste, corn husk, corn cob, okra husk, pulp, and chestnut bark were used as substrate to be added to the mycelium. The selection of substrates required for the nutrition of the mycelium was determined by considering the studies in the literature and rapid supply conditions. In addition, in the choice of substrates to be added to the mixture, care was taken to ensure they were waste materials. The materials used as substrates differ in size and in terms of the cellulose, hemicellulose, and lignin ratios they contain.

While the mycelium is growing, each surface to be used is sterilized with 70% ethanol in order to prevent bacteria induced mold growth. Mycelium, previously inoculated with oat bran, was manually dissected in a container and mixed with sterilized substrates. The mixture was mixed until it reached a homogeneous consistency. The prepared mixture was left to grow for 7 days in micro perforated bags specially produced for fungal growth in order to create a free growth environment. The incubation environment for MBCs is completely dark, adjusted to $80\pm 5\%$ relative humidity and $24\text{ }^{\circ}\text{C}$. At the end of the first 7-day period, the mixtures in the bag were poured into a sterile container, crushed and mixed until the resulting whiteness dissipated. The mixture was then sterilized and allowed to grow in molds with dimensions of $40\times 40\times 160\text{ mm}$, covered with stretch film. After the molding process, the mold was covered with stretch film and holes were drilled on it for the sample to breathe. All samples left to grow in the mold were removed from the mold after 7 days. This process is important in order to ensure equal growth of the mycelium on every surface. The samples, whose growth time was determined as 21, 28 and 35 days, were placed back in the growth medium. The samples that completed their growth periods were exposed to heat treatment at $100\pm 5\text{ }^{\circ}\text{C}$ for 45 minutes in order to stop the mycelium growth inside. This process is important in order to put an end to the active growth of mycelia. Other samples were taken from the growth medium according to the planned periods of 21, 28 and 35 days and heat treatment was carried out at $100\pm 5\text{ }^{\circ}\text{C}$ for 45 minutes. The produced MBCs content and the mixing ratio information are given in Table 4.

Table 6. MBC's content and mixing ratio.

Sample No	Mycelium Type	Substrate	Mycelium:Substrate
1		Rice Husk	
2		Straw	
3		Rice Husk Powder	
4	<i>Pleurotus ostreatus</i>	Beech Sawdust	1:2
5		Walnut Shell	
6		Oat	
7		Coconut Shell	



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8	Hemp Fibre
9	Banana Peel
10	Banana Wood Fibre
11	Textile Waste
12	Corn Husk
13	Corn cob
14	Okra Shell
15	Pulp Paper
16	Chestnut Shell

2.3. Experimental Studies

In this section, the physical and mechanical property determination tests applied to determine the basic properties of the MBCs are discussed.

2.3.1. Physical Property Tests

Tests were carried out to determine MBC's dry density, moisture content, and water absorption rate.

Dry density was calculated by the ratio of oven-dry mass to volume based on ISO 9427 (ISO 9427, 2003). Three samples were used for each mixture in the experiments, and the average of the measurement results was taken. Dry density was calculated using formula 3.1.

$$p = \frac{m}{b_1 \cdot b_2 \cdot t} \times 10^6 \quad (3.1)$$

m: is the mass of the test piece, in grams (g).

b1 -b2: are the width and the length of the test piece, in millimetres (mm), (b1 = b2).

t: is the thickness of the test piece, in millimetres (mm).

The moisture content calculation is based on ISO 16979 (ISO 16979, 2003) Measurements were calculated using formula 3.2.

$$H = \frac{m_0 - m_1}{m_1} \times 100 \quad (3.2)$$

m₀: is the initial mass of the test piece, in grams (g).

m₁: is the mass of the test piece after drying, in grams (g).

Water absorption rate measurements by weight were made according to BS EN 1936 (2006) Three samples were used for the experiments and the water absorption rate was calculated using the formula 3.3.

$$a_s = \frac{m_s - m_d}{m_d} \times 100 \quad (3.3)$$

a_s: water absorption (%) by weight at atmospheric pressure.

m_d: mass of the dry specimen, in grams.



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m_s : mass of the saturated specimen, in grams.

2.3.2. Mechanical Property Tests

The compressive and flexural strengths of MBCs were measured using an MFL brand 100 kN controlled loading device. It should be noted that the samples are not full size due to mycelium growth and have rough surfaces. In addition, MBCs, which are ductile materials, did not disperse after flexural tests. For this reason, compressive strength tests were carried out by dividing the samples with a utility knife. Flexural strength measurement is based on BS EN 196-1 (2016). Three samples were used for each composite mixture, and calculations were made by taking the average of the results. The flexural strength was calculated using the formula 3.4.

$$R_f = \frac{1,5xF_fxl}{b^3} \quad (3.4)$$

R_f : is the flexural strength, in megapascals.

b : is the side of the square section of the prism, in millimetres.

F_f : is the load applied to the middle of the prism at fracture, in newtons.

l : is the distance between the supports, in millimetres.

Compressive strength measurement is based on BS EN 196-1 (2016). Measurements were made on three samples each and calculated using the formula 3.5.

$$R_c = \frac{F_c}{1600} \quad (3.5)$$

R_c : is the compressive strength, in megapascals.

F_c : is the maximum load at fracture, in newtons.

1600 : is the area of the platens or auxiliary plates (40 mm × 40 mm), in square millimetres.

3. FINDINGS and DISCUSSION

In this section, the results of the physical and mechanical property tests are presented, starting with the growth analysis of the samples produced in the studies, depending on the production parameters.

3.1. Investigation of Mycelium Growth

MBCs were produced by mixing 16 different substrates with *Pleurotus ostreatus* in order to observe the effect of substrates on the growth and properties of the composite formed. In the composites formed as a result of experiments 1,3, 5, 6, 8 and 9, molding occurred during the growth period and mycelium growth did not reach the level to completely cover the surface. In addition, scattering was observed in the samples of tests 1, 3, 5, 7, 8, 10, 12, 13, 14 and 16, due to little or no growth of the binding mycelium. In the composites formed as a result of tests 2, 4, 11 and 15, mycelium growth surrounded the surface and the materials were allowed to adhere to each other. No mold growth was observed during the 28 day growth period. The visuals of the composites formed as a result of the tests are given in Figure 2.

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Sample No	Substrate	Sample	Detail
1	Rice Husk		
2	Straw		
3	Rice Husk Powder		
4	Beech Sawdust		
5	Walnut Shell		
6	Oat		
7	Coconut Shell		
8	Hemp Fibre		
9	Banana Peel		
10	Banana Wood Fibre		
11	Textile Waste		
12	Corn Husk		
13	Corn cob		
14	Okra Shell		
15	Pulp Paper		
16	Chestnut Shell		

Figure 6. Mycelium growth in samples formed as a result of experiments.

3.2. Physical Property Tests Results

The volume calculation was made by taking into account the irregularity in the shapes of the samples due to mycelium growth. The volume, initial weight, dry weight, dry density and moisture content of the samples are given in Table 5. Dispersion was observed in the samples belonging to tests 3, 9, 10, 12, 13, 14 and 16 due to low and no mycelium growth. Therefore, relevant measurements could not be made. Since the water absorption rate will determine the material's durability over time, it is an important factor in determining the potential of MBCs in various uses, such as indoor applications and insulation material. High water absorption rates are expected as the composite components are organic products. The data on the water absorption rate of the test samples under atmospheric pressure are given in Table 5. When the



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MBCs are compared, it is seen that test samples 4 and 6 have relatively less water absorption than the other samples.

Table 7: Physical property tests results.

Sample No	Dry Density (g/mm ²)	Moisture Content %	Water Absorption Rate by Mass (%)
1	148,13	46,18	206,81
2	131,19	117,03	411,13
3	Not measured.		
4	383,57	59,71	74,51
5	495,15	30,69	135,22
6	464,66	7,49	57,16
7	271,39	13,15	202,73
8	378,5	6,42	195,71
9	Not measured.		
10	Not measured.		
11	283,98	25,42	224,35
12	Not measured.		
13	Not measured.		
14	Not measured.		
15	280,50	70,77	222,82
16	Not measured.		

3.3. Mechanical Property Tests Results

Since there is no standard test procedure for MBCs, the test was stopped when cracks began to appear in the specimen during the flexural strength measurement. In the compressive strength, the test was stopped when the compression value of 43% was reached based on the literature (Gauvin et al., 2022). Since adequate mycelium development was not observed in tests 1, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, and 16, the retention rates of the mixture components against each other are meager. Therefore, the samples were scattered, and mechanical tests could not be performed. The values in the measured samples are partially consistent with the growth observations in previous studies. Samples containing beech sawdust and pulp with dense white mycelium biomass showed higher strength than straw and textile waste samples. In the reference study, samples containing rapeseed straw showed a compressive strength of 0.452 MPa, and samples containing cellulose fiber showed a compressive strength of 0.145 MPa (Gauvin et al., 2022).

In addition, ductile fracture is observed in experiments 11 with textile waste and 15 with pulp. The findings obtained in our study are similar to the previous study. With the study in which different substrate were tested, it is seen that the substrate properties have a significant effect on the composite material. Data on mechanical property tests are shown in Table 6.



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Table 8. Mechanical property tests results.

Sample No	Composite Content	Flexural Strength (MPa)	Compressive Strength (MPa)
1	<i>P. ostreatus</i> + Rice Husk	Not measured.	
2	<i>P. ostreatus</i> + Straw	0,37	0,21
3	<i>P. ostreatus</i> + Rice Husk Powder	Not measured.	
4	<i>P. ostreatus</i> + Beech Sawdust	0,39	0,32
5	<i>P. ostreatus</i> + Walnut Shell	Not measured.	
6	<i>P. ostreatus</i> + Oat	Not measured.	
7	<i>P. ostreatus</i> + Coconut Shell	Not measured.	
8	<i>P. ostreatus</i> + Hemp Fibre	Not measured.	
9	<i>P. ostreatus</i> + Banana Peel	Not measured.	
10	<i>P. ostreatus</i> + Banana Wood Fibre	Not measured.	
11	<i>P. ostreatus</i> + Textile Waste	0,11	0,08
12	<i>P. ostreatus</i> + Corn Husk	Not measured.	
13	<i>P. ostreatus</i> + Corncob	Not measured.	
14	<i>P. ostreatus</i> + Okra Shell	Not measured.	
15	<i>P. ostreatus</i> + Pulp Paper	0,30	0,34
16	<i>P. ostreatus</i> + Chestnut Shell	Not measured.	

4. CONCLUSION and RECOMMENDATIONS

The preliminary research findings contribute to the field of biological materials as it provides an overview of the manufacturing processes of MBCs, particularly mechanical and physical experiments. This study investigates the possibilities of producing MBCs by combining *Pleurotus ostreatus* type mycelium with different types of lignocellulosic reinforcements pioneered by studies in the literature. The study's main purpose is to determine the appropriate environment and conditions for producing MBC under current laboratory conditions by conducting preliminary tests. In addition, this study is important in determining the mixing ratios to be used in forming MBCs and eliminating the lack of information from the information not shared in the current literature due to various concerns. When the growth periods of the test mixtures prepared with the mixing ratios of the two referenced studies were examined, it was seen that the growth was at the minimum level in the mixture with a mycelium + substrate ratio of 1:4. The expected yield was obtained from a 1:2 mixture of mycelium + substrate. In order to determine the effect of the substrate to be used on the composite, several preliminary physical and mechanical tests were carried out on the samples formed with 16 different substrates at the determined mixing ratios. Different growth rates were observed in the samples produced. One possible explanation for these results is that a growth difference occurs due to the difference in cellulose, hemicellulose, and lignin ratios in the feedstocks.

Although the mechanical properties still need to be optimal, this research shows that MBCs have the potential to replace petroleum based materials. However, the water absorption rate of



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the composite consisting entirely of organic materials should be reduced for structural applications.

The methodology used to evaluate the suitability and selection of organic waste streams through preliminary studies has also proven effective for MBCs production applications. The study shows that the manufacturing process affects the desired properties of the composite. In addition, further research should be carried out in order to learn the potential of the composite to meet other relevant properties expected from insulation materials.

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DEVELOPMENT OF FACADE DESIGN IN TRADITIONAL KONYA HOUSES

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ABSTRACT

It is seen that the facade character of Traditional Konya Houses has changed depending on the plan type in the historical process. When we look at the first examples of traditional Konya houses, the importance given to functionality in the plan left ornamentation and aesthetics in the background; this situation was reflected on the facade as simplicity. Later, with the development of materials and construction techniques, the importance given to the facade increased; two different facade features, asymmetrical and symmetrical, began to be seen. The widespread use of houses with a space called "life" in Konya caused asymmetrical designs to be seen more frequently. Especially L-type house plans with inner sofas can be given as examples of asymmetrical houses. Symmetrical facades, on the other hand, have started to be preferred to emphasise the wealth, position or prestige of the owner of the house with the increasing importance given to exterior appearance as well as functionality. Facade designs were created by being influenced by various European architectural movements, especially Baroque and Neoclassical, and applications were made through craftsmen who learnt the techniques and motifs of these movements. In this study, facade elements of traditional Konya Houses are analysed under five headings: materials and techniques, door and window joinery, overhangs, roof and eaves, ornaments and motifs.

Keywords: Konya Houses, Architectural Facade, Traditional Ornaments and Motifs.

1. INTRODUCTION

People also change the place they live in with the knowledge they acquire over time and the technology they use. It is seen that Konya houses have also changed in the historical process. The breaking time of this change is the emergence of the idea of westernization at the end of the 19th century, transportation, communication systems and the change in economic conditions in Konya (Aygör, 2020).

When it comes to Konya House, different plan types come to mind. Traditional Konya Houses are built with mudbrick material, in the plan type with "hayat"(courtyard) or "mabeyn", with flat earthen roofs, in an order in which dead-end streets take place in social life. Around the houses; there are spaces that provide socialization with life, garden and outbuilding sections. Houses are generally built on a single storey. Dead-end streets created social spaces with neighbors. According to Islamic life, garden walls are high for hiding and protection, and ground floor street facades are left deaf. It is possible to see a design closed to the outside in most of the traditional Konya Houses. Houses consist of their own inner worlds (Dülgerler, 2014).



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Various factors have been effective in the development and change of Konya Houses. Increasing population due to urbanisation, economy, change of labour force, migration movements, western architectural elements, technical developments in architecture have affected traditional houses. Stone and brick started to be used as building materials. The plan with interior sofas became widespread, gradually expanded and increased in size. Roofs were started to be used in the upper cover. Houses have two or three storeys. With the disappearance of gardens in Traditional Konya Houses, the transition from public space to private space has been achieved. Streets lost their importance in terms of social relations and remained as roads to reach the houses. When the idea of a multifunctional room disappeared, the use of a load and gusülhane in each room also disappeared (Özer, 1989). The kitchen and latrine in the garden were moved inside the house. With the connection of mains water to the houses, fountains, baths and hammams started to take place inside the houses. With all these changes and transformations, facade design, which is one of the most important elements, has also started to change. For this reason, the importance of traditional facade design has become even more important.

2. MATERIALS and METHODS

The aim of this study is to examine and evaluate the facade architecture of Traditional Konya Houses in the historical process and to present a general compilation study. In this context, literature reviews related to the subject were made, observations and on-site examinations were made and determinations were made about the facade architecture.

3. FINDINGS and DISCUSSION

It is seen that the facade character of Traditional Konya Houses has changed depending on the plan type in the historical process. When we look at the first examples of traditional Konya houses, the importance given to functionality in the plan left ornamentation and aesthetics in the background; this situation was reflected on the facade as simplicity. Later, with the development of materials and construction techniques, the importance given to the facade increased; two different facade features, asymmetrical and symmetrical, began to be seen. The widespread use of houses with living rooms in Konya caused asymmetrical designs to be seen more frequently. Especially L-type house plans with interior sofas can be given as examples of asymmetrical houses. Symmetrical facades, on the other hand, have started to be preferred mostly to emphasise the wealth, position or prestige of the owner of the house with the increasing importance given to external appearance as well as functionality. Facade designs were created by being influenced by various European architectural movements, especially Baroque and Neoclassical, and applications were made through masters who learnt the techniques and motifs of these movements (Aygör, 2020). In Figure 1, Arapoğlu Kosti House, one of the important architectural structures of Konya, which has a symmetrical design, is given. In this part of the study, the facade elements of Konya houses are examined under five headings: materials and techniques, door and window joinery, overhangs, roof and eaves, ornamentation and motifs.



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Figure 1. Rock tombs (Dinc & Gül, 2022)

a. Material and Technique

Common materials in Konya Houses are stone, brick, adobe, wood, reed, reed, reed, kindıra, famerite, tile, various metals and concrete. In houses where the facade is left plain, the main building material has a direct effect on the character of the facade. In this respect, the choice of material is very important in terms of both the construction phase and the aesthetic value of the house. Stone material is used as the foundation material in almost all of the traditional Konya Houses and it is seen that it is extended to the flood level in many houses. Factors such as the type of stones, their sizes, corner stones, colours, and the way they are arranged are the factors affecting the character of the facade. Adobe is a building material applied with masonry technique which is frequently preferred in Konya. The suitability of the existing soil chemistry for use as a building material has been effective in this preference. Adobe and stone materials were widely used in Konya Houses not only in building construction but also in the construction of elements such as all auxiliary units and garden walls next to the house (Aygör, 2015).

Although brick is a material commonly used in the construction of partition walls today, it is a material preferred in the construction of hedgehog eaves in Traditional Konya Houses. Hedgehog eaves is a technique created by different arrangement of brick corners and gives movement to the facade. Wood has always existed in Turkish culture and has always been an important building material of the Traditional Turkish House. The use of wooden materials is widespread from basic carrier elements such as wooden struts, wooden beams and struts to interior fittings (Karpuz, 2001). Reed, thatch and kindıra are traditional materials used in Konya houses. They are mostly used in floor coverings, ceilings, roof covers and garden walls. Famerit, i.e. Italian tile, is a type of material mostly used in flooring. It is frequently seen in public buildings (Sözen & Tanyeli, 1996).

Roof tiles appear in two different forms. These are Alaturka and Marseille type tiles. Alaturka type tiles are the first application seen after the earth roof applied as roof cover in Konya (Hasol, 1998). However, due to the high weight of this type of tile, it was replaced by Marseille type tile after a while. Marseille type tile is a machine produced product. In the 19th century, the products imported from Marseille started to be produced in Turkey. In Ragıp Anadolu House, one of the important houses of Konya, there are Marseille type tiles (Figure 2).

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Various metal applications are mostly seen in railings and stair railings.



Figure 1. Marseille type tile on the east facade and roof of Notary Ragıp Anadolu Residence (Aygör, 2015)

When the construction techniques in Traditional Konya Houses are analysed, it is possible to see masonry (masonry), hımış and bağdadi techniques. The most commonly observed masonry technique is the type of construction in which mostly stone and mudbrick materials are placed on top of each other and connected with beams (Hasol, 1998). Hımış, on the other hand, is a construction technique obtained by filling the wooden frame with mudbrick, stone or brick. While a single material can be selected as filling material in a dwelling, in some dwellings more than one material is used for filling purposes (Sözen & Tanyeli, 1996). Bağdadi construction technique is the construction technique in which the slats between the wooden uprights are filled with mudbrick and then plaster is applied on top. In Konya Houses, it is mostly applied on projections and attics (Sözen & Eruzun, 1992). Bağdadi technique is also used for ornamentation purposes with jamb and lintel appearances on the facades (Günay, 2007).

b. Doors and Windows

In Konya Houses, the entrance doors to the house are mostly wooden. Over time, with the processing of various metals and the ease of manufacturing, metal doors with security-enhancing qualities have started to be seen. The construction technique of wooden doors is of two types: nailed and trayed. The nailed doors form a part of the general facade design in traditional houses and show integrity with the facade. Trayed doors are mostly doors that have been changed later. It is possible to categorise the doors on the facade in three groups as "garden doors", "external entrance doors" and "entrance doors with table".

Garden doors are located on the garden wall in Traditional Konya Houses. They are mostly double winged and in hammered technique. The carvings and binding nails on the door repeat in a certain order and it is aimed to obtain an aesthetic appearance. The external entrance doors are mostly single winged and were used for entrances to auxiliary units next to the dwelling such as barns. Exterior entrance doors with tray are generally symmetrical doors produced in a wide variety of designs.

When the window joinery of Konya Houses are analysed, it is seen that wooden joinery is widely used. Aygör (2015) divided the windows into three groups according to their opening types: guillotine, fixed at the top, two-winged at the bottom and two-winged windows opened at the top and bottom. The facade where the window is located directly affects the design of the window, whether it is opened or not, and the opening direction.

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c. Overhangs

It is seen that the overhangs were constructed with bagdadi or himiş technique in Konya Houses. Due to the construction technique, the wall thicknesses in the projections have a width of 20-30cm. The overhangs are mostly located in the living room. Therefore, the width of the overhang is determined by the dimensions of the room. The fact that the place where the protrusion is located in the hall is turned into a sitting place by raising it with wooden supports is a formation frequently seen in Konya Houses. This area is furnished with ottomans and it is aimed to create a bright sitting environment with large windows. The windows here are mostly guillotine type.



Figure 3. Types of overhangs (Aygör, 2015)

When the upper cover of the overhangs is analysed, it is seen that either a design directly attached to the main roof or a roof cover design specific to the overhang was created. In the lower part of the overhangs, it is seen that there are buttresses (eliböğründe), which have both a carrier and aesthetic appearance and are mostly made of wood. Aygör (2015) analysed the projection types in 5 groups as "one-way, two or three-facade projections", "miter room projections", "facade projections", "three-cornered projections", "five-cornered projections". The specified projection types are given in Figure 3.

Another type of formation seen on the facades of Konya Houses are jihannumas and balconies. Cihannumas are located on the roof floor. It is independent from the general roof cover and has its own top cover. It is a kind of observation terrace (Hasol, 1998). In this respect, it gives movement to the facade. Balconies appear in two forms in Konya Houses. The first one is the balconies built as an extension of the building in the form of a projection. These balconies are either open or have their own roofs. The second is the type of balcony created by leaving a space between the rooms and pulling this space inside. In this type of balconies, the roof cover of the house also covers the balcony (Aygör, 2015).

d. Roof and Eaves

Two types of roofs are commonly seen in Konya Houses.

- Flat Roofs with Earthen Roof
- Alaturka Tile Covered Sloping Wooden Roofs

Flat Roofs with Earthen Roofs: It is positioned on thick wooden beams with round cross-section. Beam spacing is kept short to ensure strength. 30-40 cm clay soil is laid on the bearing beams and compacted. Since the clay soil varies depending on the weather conditions, in rainy weather, a hand roller called "loğ stone" is used on the roof for compaction. This process is important in terms of waterproofing (Turkosfer, 2023).



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Alaturka Tile Covered Sloping Wooden Roofs: This type of roofs are frequently encountered in traditional Turkish houses. The roof construction is of wooden sitting roof type and it allows large openings to be passed compared to flat roofs with earth roofs. In timber frame buildings, the roof is placed on the carrier frame. Due to the slope, the gable roof gable ends on the rear or side facades are used as exhibits for storing vegetables and fruits. Alaturka tile used as roof covering is a corrugated roof covering material made of terracotta (Aygör, 2020).

Eaves, which are one of the characteristic features of Traditional Turkish Houses, are one of the important elements in facade architecture. The eaves, which are a part of the upper cover that can be felt and observed from the ground level, have a direct effect on the mobility of the facade.

Another effective element on the facade is the bay windows. In the Turkish house, with the help of bay windows and eaves, the rooms were enlarged, a good lighting and ventilation solution, orientation to the view, and protection of the entrance door from rain were obtained. While achieving these solutions, principles such as aesthetics, proportion and most importantly being on a human scale have always been observed. In the facade design of the Turkish house, eaves and bay windows provide harmony and harmony between fullness and emptiness. When we bring together elements such as the $\frac{1}{2}$ ratio in doors and windows, the shaping of the bay windows in relation to the living room, and floor heights, all the characteristic features of the Turkish House appear in harmony with the environment and people in a unity (Figure 4) (Günay, 1998).

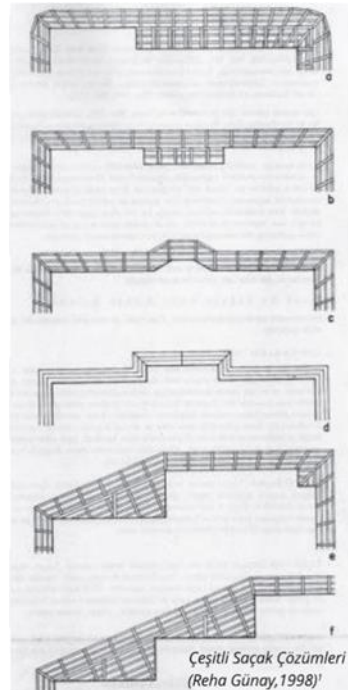


Figure 4. Various eaves types (Günay, 1998)

e. Ornament and Motifs

In traditional Konya Houses, it is seen that ornamental elements are concentrated in the interior rather than the exterior. In Konya Houses, which have developed and changed over time, it can



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be said that the ornamental motifs on the exterior facade have increased. For this reason, the ornamental qualities of Konya Houses will be explained under two headings: exterior ornamentation and interior ornamentation.

- **Exterior Decorations**

Exterior ornamentation is not frequently seen in Traditional Konya Houses. The houses are designed quite simple in terms of their facade appearance. The simplicity of the material is the most important element of the facade. However, it is possible to talk about spiked eaves and different arrangements of building materials that will give mobility to the facade (Erpi, 1987).

Stone: In Konya, it is possible to see stone materials in ornamentation. Sille and Gödene stones are frequently used. It is also common to use it together with different materials. In the combination of different materials, stone is used up to the level of the water basement and then it is possible to switch to different materials. The use of stone material is also frequently seen in the corner stone application, which has a static quality. Corner stones also give a characteristic quality to the facade. Corner stone applications can be seen in two forms as surprised and straight. In the staggered arrangement, rectangular and square pieces are arranged one on top of the other in an orderly manner in the vertical direction. In the straight arrangement, rectangular or square pieces are raised vertically on a single surface (Aygör, 2015).

Wood: Wood also has an important place in exterior ornamentation. Wooden ornaments are found on entrance doors, windows, eaves and overhangs. In traditional Konya Houses, it is known that the ornamentation on the exterior doors is made with large cabara nails on nailed doors. This type of examples are also encountered in old Konya photographs (Aygör, 2015).

- **Interior Decorations:**

It is possible to see similarities between the motifs and decorations seen in the interior of the Turkish House and the facade decorations. In this respect, interior decorations were also examined under a title within the study, but since the subject of the study is within the scope of exterior facade features, only a brief information about interior decorations was given.

In interior ornamentation, Konya Houses do not make a complete distinction with the traditional Turkish House. In the developing and changing houses, except for the houses with furnished equipment, the interior equipment is generally similar to the traditional Turkish House. However, gradually over time, the same interior equipment in every room has started to disappear.

"S" and "C" curves, which are mostly seen on the interior fittings and have baroque inspirations, are also encountered on the exterior facade (Aygör, 2015).

4. CONCLUSION and RECOMMENDATIONS

It has been determined that Konya houses exhibited two types of construction in the early 19th century and the first half of the 20th century, with a traditional style and European architectural influences. It is seen that the facade design of a traditional Konya House is quite simple. The entrances to the garden or side facades are not remarkable. These entrances lead directly to the courtyard. The main entrances of the houses have flat rectangular wooden frames and are at the same level with the ground. The roofs are generally flat earth roofs with traditional features, and in some examples, gable roofs were added later.



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All these findings show the existence of a rich house architecture in Konya. As a result of the investigations, it has been observed that historical houses in Konya are experiencing a rapid process of extinction. There are many street sanitation and restoration practices carried out by the public in the name of protection. However, it is seen that these applications are insufficient. Konya should protect the historical Konya Houses by providing the contribution of the public and private sector in a way to satisfy its own people.

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**BIBLIOMETRIC ANALYSIS FOR NOISE BARRIER AND DESIGN WITHIN THE
SCOPE OF HIGHWAY NOISE PLANNING**

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ABSTRACT

Highway noise, which emerges as one of the most important environmental noise sources in cities, affects educational areas, settlements, recreational areas, etc. It negatively affects the use of many urban areas and human life. In this context, noise planning studies are carried out and various methods are applied to reduce/prevent highway-borne environmental noise. Noise barriers are one of the methods created to reduce the negative effects of environmental noise. In the study, bibliometric analysis of research on noise barriers and their designs within the scope of highway noise planning is presented. With the analysis, using the keyword "highway noise barrier and design", the areas in which the studies in this field are concentrated, the subjects of study, the aging rate of the subject, the development process in time, the distribution according to countries and authors, the most influential authors and journals on the subject were revealed. Studies in peer-reviewed journals between 1980 and 2020 were scanned in the WOS database (325 scientific studies) and analyzed through the R program. Analyzes are presented with various network and clustering graphs. In the study, which provides an overview of noise barriers and design, it is seen that the publications listed chronologically have increased significantly since 2010 and that studies on air pollution, pressure and noise barriers have increased in recent years. This study aims to reveal the main trends and gaps in the literature regarding highway noise planning and noise barriers.

Keywords: Noise Planning, Highway Noise Barrier, Bibliometric Analysis, Barrier Design.

1. INTRODUCTION

In recent years, the increase in environmental pollution caused by natural and human factors has increased concerns about environmental problems and environmental protection (Pandya, 2001). In addition to the negative effects on the environment, environmental pollution affects urban users physically and psychologically (Liu et al., 2021). Solutions are sought and developed by local governments and planners for noise pollution, which is primarily one of the environmental problems (Barrigón et al., 2010). The concept of noise was first discussed as a pollutant at the World Environment Congress in Stockholm in 1.972 (Buss, 2007).

Highway noise is seen as the most important noise source in cities. Highway noise is related to many factors related to the city and the morphology of the city, and the physical condition of the highway, the condition of the vehicles and the speed of the vehicles are effective on the



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noise level (Crocker, 2007; Abhishek et al., 2012). In urban residential areas, highway noise is mainly dependent on highway-generated noise and noise parameters reflected from building surfaces (Apparicio et al., 2018; Szopińska et al., 2022).

Noise action planning should be included in urban planning against noise pollution that negatively affects human health and quality of life (Brown & Van-Kamp, 2017; Singh et al., 2018). The main purpose of noise planning is to realize plans to reduce or prevent noise. There are various methods for noise control to minimize the urban noise impact from highways (Burge, 2019; Choi et al., 2022). The main methods included in noise action plans are speed reduction measures, use of appropriate materials on road surfaces, traffic management and noise barriers (Hintzche & Heinrichs, 2018). Noise barriers, which have emerged as one of the most effective methods to prevent traffic noise, reduce most of the noise with various designs and materials (wood, polycarbonate, glass, metal, etc.) (Pinsonnault-Skvarenina et al., 2022; Michaud et al., 2008). Noise barriers can be divided into 2 classes: structural and vegetative. In addition, these barriers are classified as long and short barriers (Lodico, 2023).

There are many examples of studies and applications within the scope of noise barriers to reduce highway traffic noise and noise in the world (Bouzid et al., 2020; et al., 2021; Yıldırım & Arefi, 2021). In order to reduce the impact of noise on human health in cities, noise planning and noise barriers should be given the necessary importance.

Bibliometric analysis research, which forms the basis of this study and enables statistical analysis of studies in a field, has been increasing significantly in recent years (Özel & Kozak 2012). New software programs enable the processing and categorization of data from academic databases. In addition, it analyzes keywords, authors, countries, journals, etc. on the subject of the study and reveals their relationship with each other (Khan et al., 2022).

In this study, which aims to provide an overview of the studies on noise barriers and designs within the scope of noise planning, a bibliometric analysis was conducted on the subject. With this study, it was tried to determine the rate of development of the subject, which topics it has evolved towards, which methods are used, country, author, journal relations and deficiencies in this field of study.

2. MATERIALS and METHODS

Articles on noise barrier and design scanned in Web of Science were used as the main material in the study. By searching the WOS database with the keyword "Highway noise barrier and design", 325 articles between 1980 and 2022, including articles, book chapters, papers and reviews, were included in the study. Bibliometric analysis was performed using R Studio software to analyze and evaluate the data obtained in the study. The analysis was conducted through the "bibliometrix" package developed by Aria and Cuccurullo (2017). Within the scope of the analysis, general information about the data, annual scientific production, relationship network of keywords, word cloud, trend topics, word growth, three fields plot, the most relevant authors, most relevant sources and the countries with the most studies were identified. All these analyses are expressed with network and clustering techniques and graphical representations.

3. FINDINGS and DISCUSSION

The studies on Highway Noise Barriers and Design are based on the years 1980-2022 as the time period. In this context, there are a total of 325 scientific studies on the subject in the WOS database and 203 of these studies consist of articles (Table 1).



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Table 1. Main information

Highway noise barrier and design	Description	
	Data Collection	
	Time Span	1980:2022
	Sources (Journals, Books etc.)	156
	Documents	325
	Document Types	
	Article	203
	Book Chapter	3
	Proceedings, Reviews et al.	119

Academic studies on highway noise barrier and design have entered a rapid development process since 2006, and a decrease in studies on this subject was observed in 2019 (Figure 1).

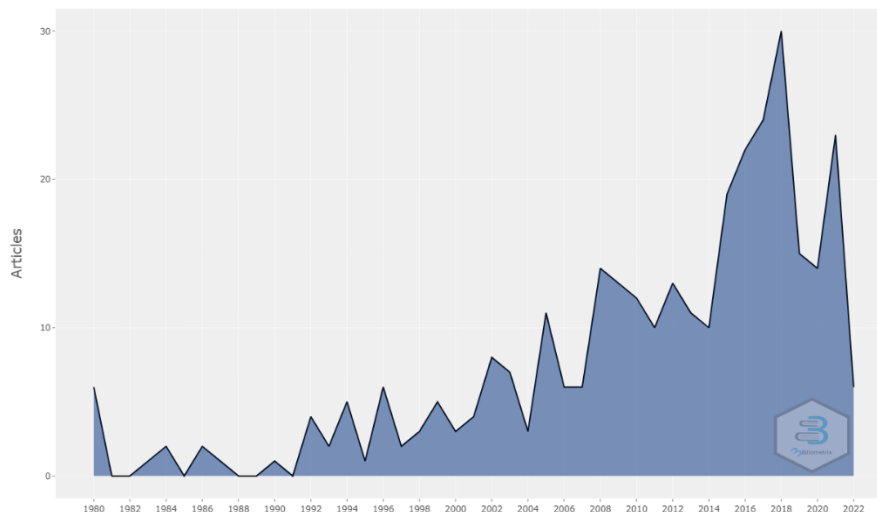


Figure 1. Annual scientific production

Within the scope of bibliometric analysis, different clusters come to the fore in the relationship network map consisting of keywords (Figure 2). In the map with 5 different main clusters, the frequency of words is related to the circle sizes of the clusters. In the study, the main cluster labels are sound, noise barriers, dispersion, model, road traffic, acoustic performance, exposure. The proximity of similarly colored concepts to each other indicates their frequency of use together, and in this context, the words used in relation to the orange group can be grouped as pressure, traffic noise model, air pollution, environmental noise, and in the green group as road traffic noise, health, prediction, disturbance, behavior (Figure 2).

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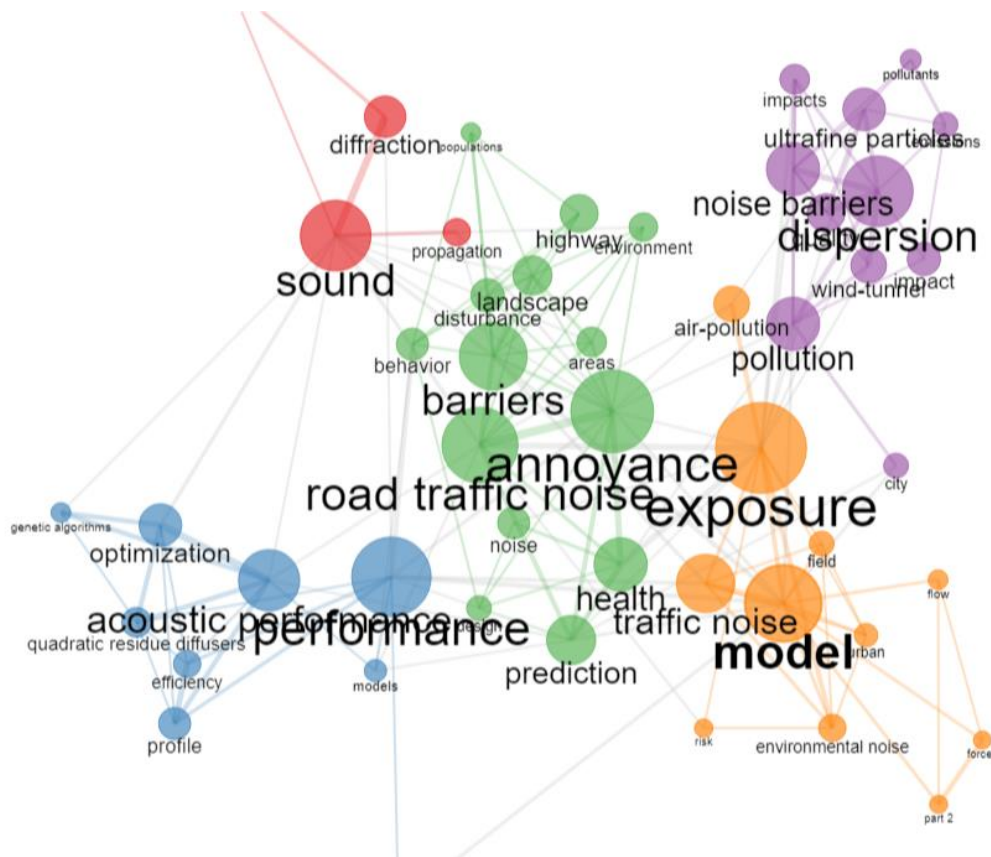


Figure 2. Network map by keywords.

In the word cloud that emerges based on word frequency, word size indicates the frequency of words used in studies. In this context, the words performance, sound, pressure, traffic noise, dispersion, barrier, which form the basis of noise barrier and design, come to the fore. In addition, it is also seen that there are studies on the words wind tunnel, air pollution, health, landscape at a smaller scale (Figure 3).



Figure 3. Word cloud



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Figure 2, which shows the trend topics of the most used words in the temporal process, is based on the years 1996-2000. In this context, it is seen that the sub-topics on the subject have increased since 2010. In recent years, studies on air pollution, pressure, city, noise and noise barriers have increased (Figure 4).

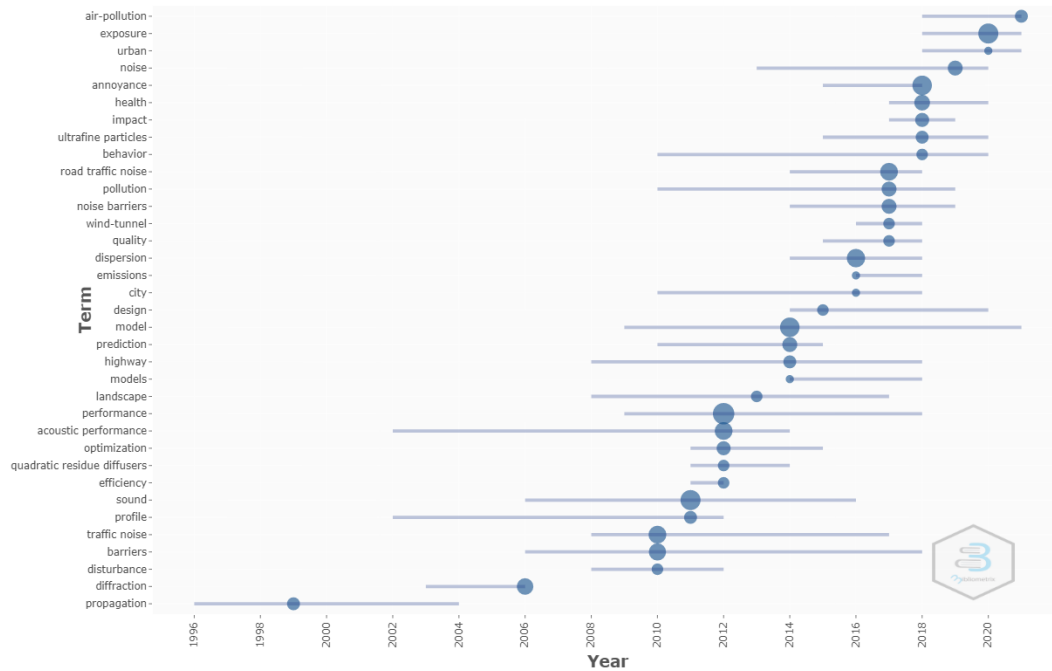


Figure 4. Trend topics

When the development process of words is analyzed, it is seen that the words performance, exposure and traffic noise have gained the most momentum. While the words annoyance and sound came to the fore in the beginning, it is concluded that the topics diversified over time, but words such as pollution remained constant between 1999 and 2007 (Figure 5).



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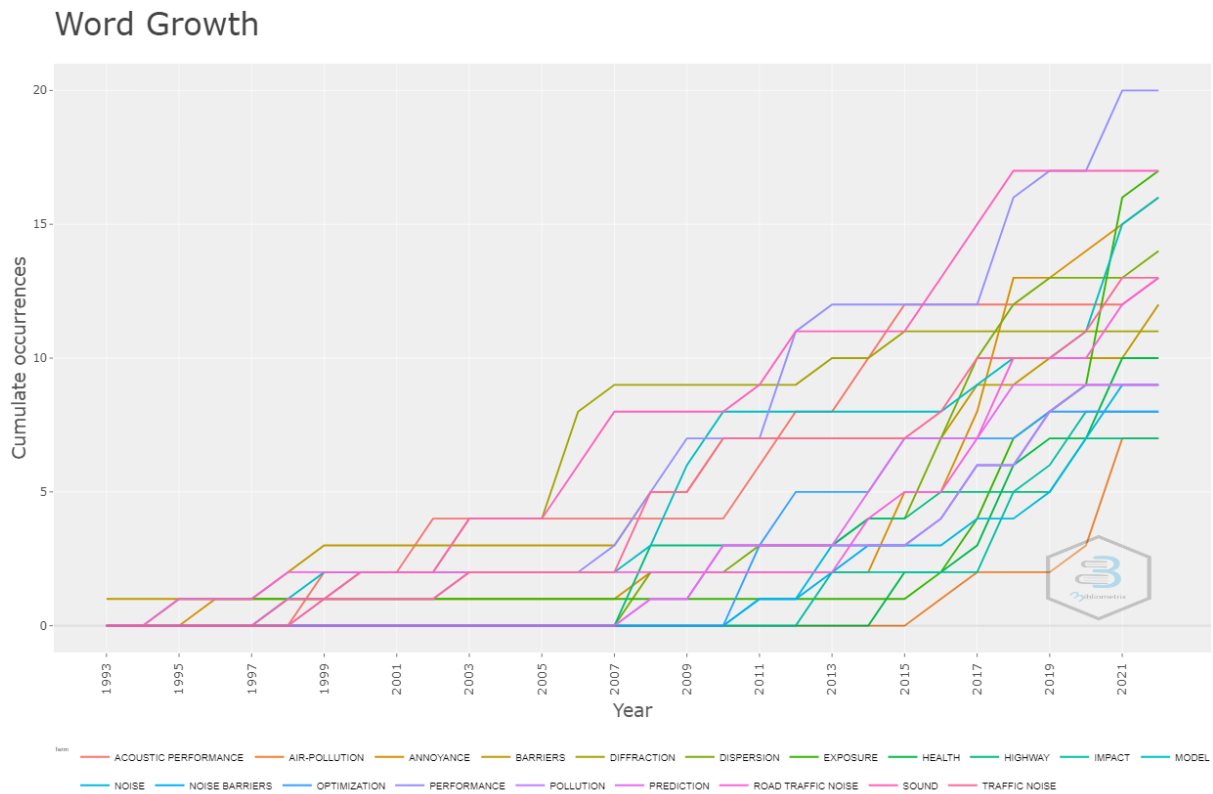


Figure 5. Word growth

In the three fields plot showing the relationship between authors, keywords and sources, journals are on the left, keywords in the middle and journals on the right. The analysis of the 20 most influential data shows that journals such as Applied Acoustics, Atmospheric Environment and Sustainability are leading the way in this field. It was revealed that most of the most relevant authors (Monazzam MR, Botteldooren D, Van Renterghem T) frequently used the words "model, performance". Although studies on air pollution have increased in recent years, it is understood that it has fewer studies, ranking lower in the analysis (Figure 6).



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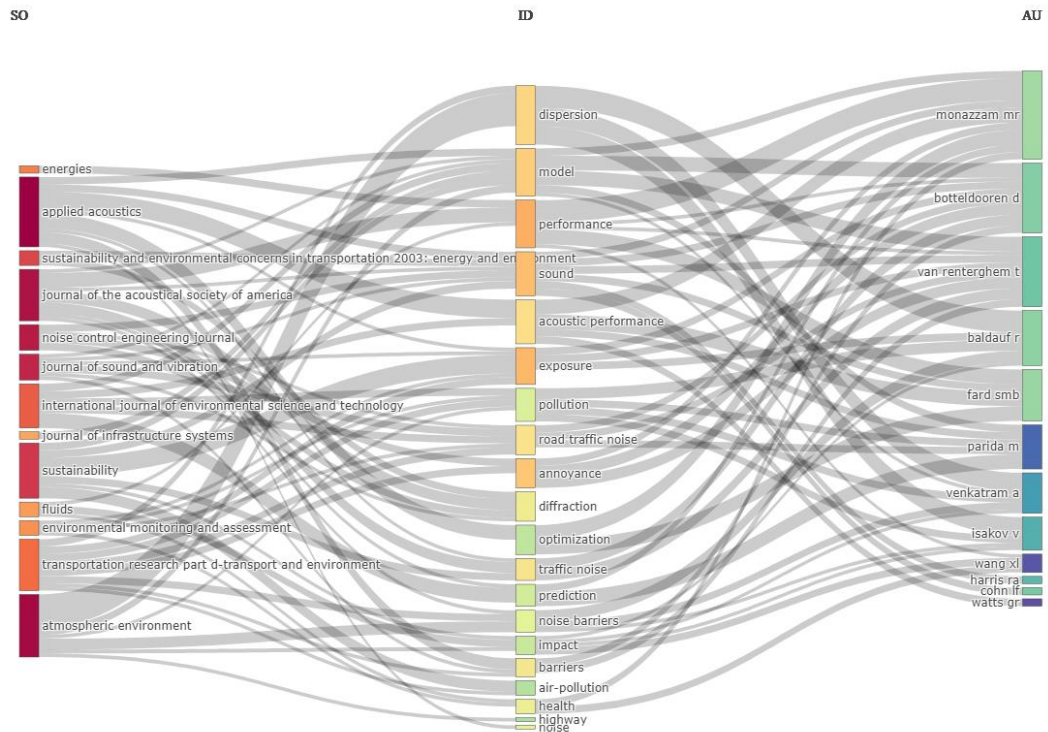


Figure 6. Three fields plot

When the country-specific distribution of scientific publications on the subject of the study is examined, it is seen that the United States, Iran, Canada and China are in the first place, while Turkey ranks 25th in scientific production within the subject. The most relevant sources on the subject are given in Figure 1. In this context, the journals with the highest number of publications are "Applied Acoustics, Atmospheric Environment, Journal of The Acoustical Society of America" (Figure 7).



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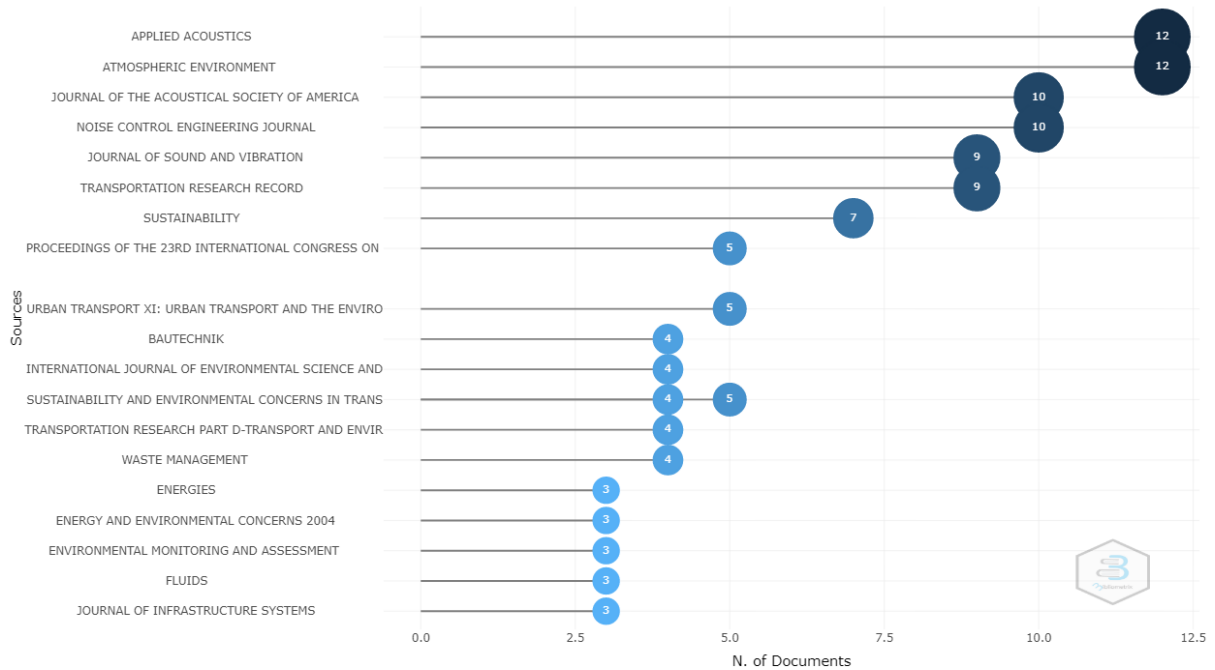


Figure 7. Most relevant sources

Figure 5 lists the most relevant authors in the field of noise barrier and design. Monazzam MR, Fard SMB and Baldauf R are the leading contributors (Figure 8).

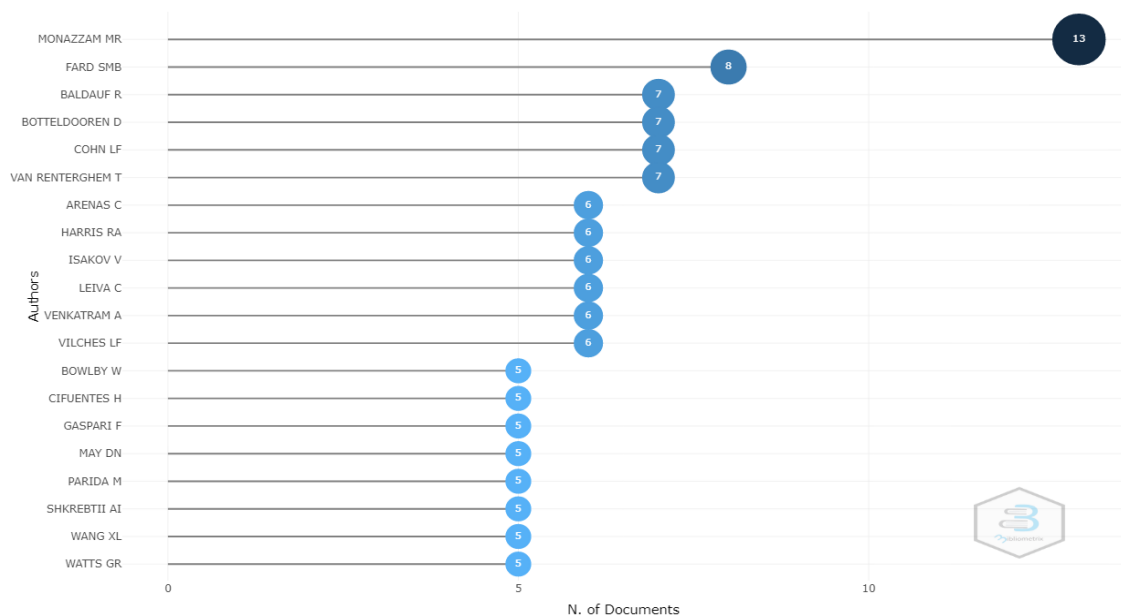


Figure 8. Most relevant authors

4. CONCLUSION and RECOMMENDATIONS

In this study, academic studies on noise barriers within the scope of noise planning were examined from the past to the present and it was aimed to provide a basis for future studies. In this context, 325 articles related to the subject were systematically reviewed, categorized and analyzed. Noise pollution, which has come to the agenda with environmental problems in



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recent years, has become an important area where measures should be taken by increasing in the temporal process. Noise barriers and their design, which have seen a significant growth in the literature since 2006, have been examined by many authors and divided into different subheadings. These diversified sub-topics include topics that aim to provide solutions to today's environmental challenges. In this context, conceptual analyses have focused on research topics such as performance, pressure, dispersion, barriers and wind tunnels, and these studies are frequently used. When the most cited studies, which form the focus of noise barrier and design, are evaluated, it is seen that acoustic performance, air pollution, traffic noise model concepts are additionally studied.

This study provides an important resource for noise planning and noise barriers and is limited to the WOS database. In future studies, increasing the scope of the subject and conducting analyzes with other databases will contribute to the subject of the study.

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LIVING IN SPACE: THE QUEST TO PRODUCE HABITATS ON DIFFERENT PLANETS AND THE ROLE OF 3D PRINTING TECHNOLOGY

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ABSTRACT

Worries about making the earth uninhabitable in the future due to the irresponsible activities of humans have triggered man's ambition for discovering and making new homes in outer space. Aligned with the competition held in Turkey for Space Research in 2022, this paper discusses designs and projects that respond to different living conditions in space. Moreover, this paper examined the idea that offers solutions for producing and utilizing materials and forms in the design according to living conditions in the space. The proposed design aims to produce the initial living spaces with the help of 3D printer robots that utilize the regolith on the Moon's surface for construction. The prototype of the proposed design was produced using 3D printing technology, with PLA as the building material. NASA's 3D printing technology, which was established for extraterrestrial research, was also examined. It has been determined that the proposed design for the Turkey Moon Bases competition is compatible with NASA's 3D printing technologies. The research concludes that the use of such tools is effective in creating a habitat on the Moon and in producing other alternative living spaces on other planets.

Keywords: Moon, Space Researches, 3D Printing.

1. INTRODUCTION

For thousands of years, Earth has been the only known planet where vital activities can be carried out. However, with the rapid depletion of resources on Earth and the exponential population growth, the search for alternative resources and living spaces has come to the forefront. As a result, the search for life and resources beyond Earth has recently attracted considerable interest. As part of this effort, many countries are investing heavily in space exploration. Some of the institutions involved in space research include the United States National Aeronautics and Space Administration (NASA), the Russian Federal Space Agency (Roscosmos), the China National Space Administration (CNSA), and the European Space Agency (ESA). In our country as well, recent efforts have been made in the field of space research. In this context, the Turkish Space Agency (TUA) was established in Turkey in 2018. The Moon, Earth's satellite, plays an important role in space research. It serves as a station for reaching the depths of space, and it is planned to travel to the depths of space from the Moon (Erdem, 2012). In addition, solutions can be developed to obtain the necessary energy from lunar resources.

One of the biggest challenges in creating extraterrestrial habitats is the lack of sufficient human labor. In this regard, different solutions are being explored for the production of living spaces



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for humans. In recent years, advanced 3D printing technology is one of these solutions. With 3D printing technology, building constructions are successfully realized today (Özeren et al., 2023). The use of 3D printing technologies with autonomous methods, which do not require human labor, is important for enabling construction and establishment on different planets. This allows for the initial stage of constructing and establishing on a new planet. Moreover, it is crucial to consider activities like consuming food and drinks, as well as socializing, which are necessary for human physical and psychological adjustment to a foreign environment.

In 2022, the Bursa Metropolitan Municipality, Bursa Technical University, Bursa Provincial Directorate of National Education, and the Gokmen Space and Aviation Training Center (GUHEM) organized the Turkey Lunar Bases National Idea Project competition. The competition aimed to generate visionary solutions for the search for life beyond Earth. Our project, designed for this competition, was awarded the Jury Incentive Award in the professional category. This work will focus on the use of 3D printing technology for lunar bases and living spaces based on the project we presented. Thus, the aim of this study is to serve as a guide for Turkey's space research.

2. MATERIALS and METHODS

This project work forms the core material for the Turkey Lunar Bases National Idea Project competition held in 2022. Additionally, it will draw from existing studies related to the Moon. In this context, during the design of the lunar base, several issues were identified and addressed under the headings of settlement, lunar features, form, shell, resource search, production, and psychological factors. The study will provide project details proposed for Turkey Lunar Bases under these headings.

3. Lunar Base Design

In the present day, changes occurring in various sectors, technological advancements, and innovations are of significant importance for the scientific community in our country. These developments, when made available and applicable, with their expanding areas of use, can contribute not only to the national economy but also to employment. Especially in the field of architecture, which constantly reinvents itself in tandem with technology, 3D printers hold a crucial place. 3D printers have become an integral part of the technological world, utilizing various materials. Although we may not directly witness these developments in our industrial sector and university laboratories, they continue to progress globally through scientific research and applications. This development encompasses material, technology, and dimension, enabling printers to acquire new functionalities.

Living and working on the Moon, due to the absence of atmosphere, primarily relies on the protection of lunar inhabitants from radiation and the maintenance of a breathable atmosphere pressure, either through spacesuits or within a natural environment (Cohen, 2002). Several challenges and risks are associated with this:

- Lack of natural light.
- Atmospheric preservation.
- Maintenance and loss of internal pressure.
- Increased personal safety risk while moving between modules (space suits and vehicles).



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- Space constraints limiting food growth, terraforming, physical exercise, mental health, and connection with nature.
- Inability to study the full physical capabilities of the human body in microgravity.
- Micrometeoroid impacts jeopardizing all habitats.
- Internal explosions.
- Radiation.
- Dust invasion in habitats.
- Thermal elastic loading.

Considering these factors, various architectural design research studies have been conducted for long-term lunar residents (van Linden Tol et al., 2022).

a. Concept

Inspiration has been drawn from the life cycle of a cocoon transforming into a butterfly for the design of a living base on the lunar surface (Figure 1). The cocoon is the chrysalis stage of an insect group that undergoes complete metamorphosis. Once their growth is complete, the caterpillar, during the transition to the adult form, creates a protective layer from a silk thread, and their body development is completed within this layer. In the design, the aim was to initially target the formation of a suitable protective layer based on the morphology of cocoon formation for unmanned vehicles sent remotely according to lunar conditions. With the completion of the cocoon, the structural base is finished and becomes suitable for human habitation, allowing the critical protective shield to be completed unmanned. Subsequently, it allows for the transformation into desired forms to meet different needs. This way, a self-sufficient and comprehensive production base is completed. Initially aimed at units for 20 individuals, over time, it enables the establishment of colonies of various sizes. The central base in the main settlement serves as a research and production center, specialized for vertical hydroponics, made of basalt glass. Interconnecting elements link different units, allowing for the abandonment of one unit and the integration of new units into the system in case of adverse conditions.

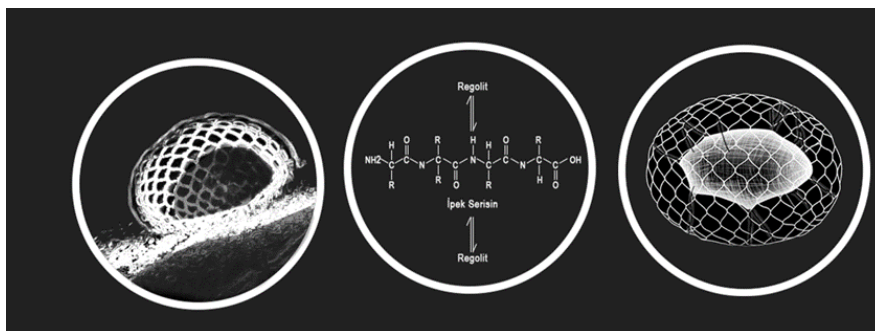


Figure 1. Cocoon concept diagram

b. Settlement on the Moon

The southern polar region of the Moon has been chosen as the settlement site with the aim of producing water from surface ice and obtaining uninterrupted energy from continuous sunlight (Figure 2). In this region, it is planned to leverage natural coverings such as natural cliffs or



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caves for an ideal settlement. Following the assurance of sufficient resources and energy supply for the establishment of a living center on the lunar surface, developments are aimed at establishing multi-center bases in the craters of Biruni, Ibn Sina, Tusi, Ulugh Bey, Ali Kuşçu, Fatih Sultan Mehmet, and Atatürk, to further these goals.



Figure 2. Settlement on the Moon

c. Local Features

The lunar surface is covered with an irregular layer of various rock fragments, which are suitable as construction materials (Horz and Cintala, 1996; Wang et al., 2022) (Figure 3). Therefore, the utilization of lunar soil presents the most economical and feasible option for on-site development and construction of lunar bases (Bennett et al., 2020).

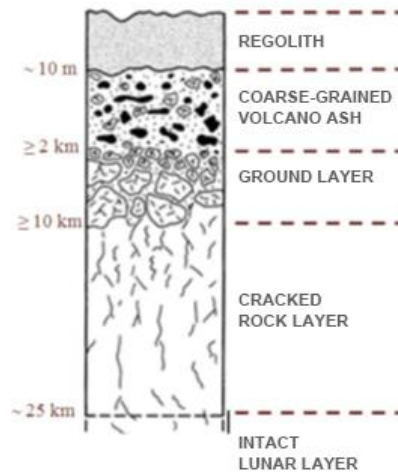


Figure 3. Geological structure of the Moon (Hörz et al., 1991)

The physical properties of lunar soil, also known as regolith, are anticipated to form the foundation of future production on the Moon and in space. The geometric and mechanical characteristics of lunar soil significantly differ from Earth's soil due to substantial environmental disparities between the two locations (Tang et al., 2020). Numerous studies have been conducted to enhance the preparation of simulated soil and apply it to lunar/Martian



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structures, aiming to increase its resemblance to actual lunar soil (Battler and Spray, 2009; Carpenter et al., 2006; Hörz and Cintala, 1997; Pitcher et al., 2016; Sibille et al., 2006; L. A. Taylor et al., 2016; Toklu and Akpınar, 2022; Zarzycki and Katzer, 2019).

According to Lin et al.'s report (Lin et al., 2022), lunar regolith is estimated to contain around 120 parts per million (ppm) of water (OH + H₂O), primarily attributed to solar wind implantation. Oxygen is also present in lunar soil, known as regolith. Oxygen can be liberated from metal oxides through various chemical processes, enabling the production of water or obtaining metal by-products. Regolith, which is envisioned for use as a construction material along with its diverse metallic components, forms the foundational building component of the lunar base to ensure sustainability and energy provision.

The utilization of lunar regolith on the lunar surface, facilitated by 3D printing robots, is aimed at producing the initial living habitats (cocoon). In this field, NASA has been known to conduct research encompassing technological advancements related to 3D printing of electronics, metals, outer-space structures, and additive repair technology (Bechthold et al., 2015). Therefore, it can be stated that the use of such tools is effective in achieving the planned objectives. At this stage, the structural potential of the coarse, fine dust known as regolith covering the lunar surface has been elucidated through studies by the European Space Agency (ESA) (Wittal et al.). Furthermore, the composition of lunar soil from various elements permits the production and use of various building materials (Franke, 2022).

d. Form

The structural formation of the cocoon draws inspiration from the architectural concept known as the 'Turkish Triangle,' a term that has made its way into architectural literature (Figure 4). Formally, the interplay of triangles in both solid and void configurations constitutes an effective shape in safeguarding against adverse lunar conditions, particularly meteorite impacts and radiation effects. Furthermore, for structures to be constructed on the lunar surface, spherical and cylindrical forms have been selected. The lunar gravity is six times weaker than Earth's, necessitating the preference for a spherical shape to adapt to this condition. Additionally, this choice ensures even distribution of potential pressures on the surfaces. The construction of these structures is planned to be carried out autonomously using 3D printers.

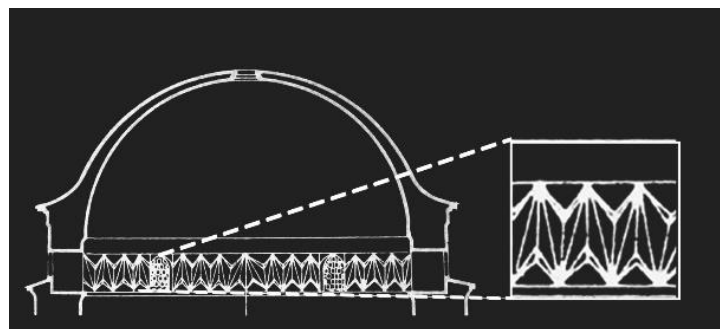


Figure 4. Lunar base formal formation

A prototype of the living module, designed with reference to the Turkish triangle shape, has been produced using a 3D laser printer. This process has demonstrated the feasibility of constructing the building under lunar conditions. The prototype in question was manufactured from filaments (Figure 5).

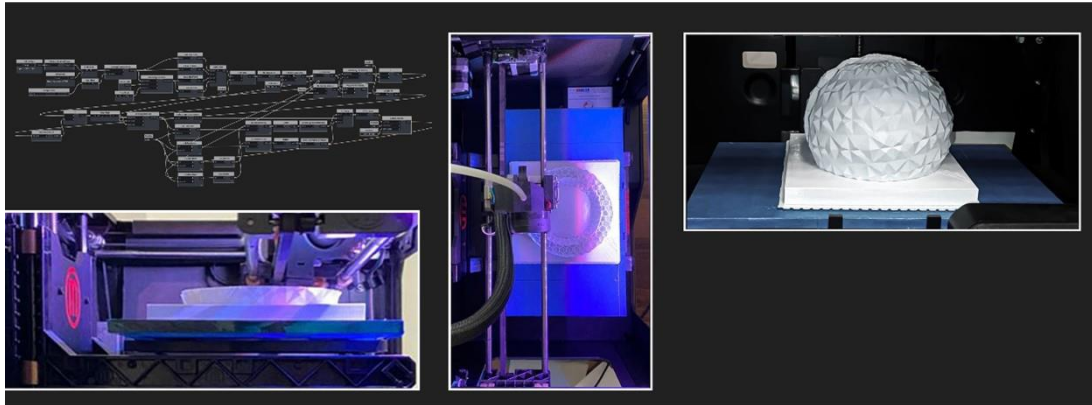


Figure 5. Prototype produced with a 3D printer

e. Structure and Cover

The philosophy of the caterpillar's life cycle has been sought to be applied throughout all stages of the construction of the lunar base. In this context, the silk protein found in the structure of the cocoon will be utilized in the shells of buildings. Silk protein possesses protective properties against UV radiation and water-binding characteristics. A novel material, with enhanced silk protein derived from the cocoon, lunar regolith, and polymers, will be developed to protect against meteorite impacts and radiation. Additionally, sustainable material cycling will be facilitated through silk production from silkworms in the production area on the lunar surface, with the aim of creating a natural habitat on the Moon.

The proposed lunar housing structure is planned to consist of three layers. The first layer is a dome that regulates indoor air quality and pressure. The second layer is a wall, made of regolith and reinforced silk, designed to withstand radiation and 3D printing. The third layer forms a surface with a Turkish triangle motif, referred to as the "pupa" (Figure 6).

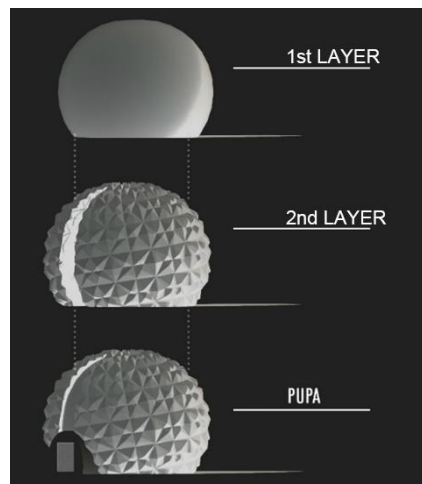


Figure 6. Habitat formation layers

f. Search for Source

Photovoltaic panel arrays, along with solar concentrators that provide heat for processes such as 3D printing, can generate electricity. Solar panels can supply energy from sunlit areas to



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shaded regions. Solar-powered electrolyzers can split water into oxygen and hydrogen, which can be used as a propellant or recombined in fuel cells for energy during nighttime.

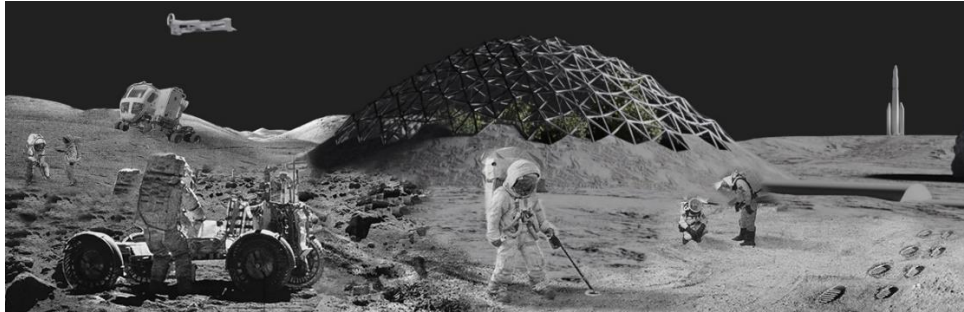


Figure 7. Moon base production center and mobile devices used for resource quest

Exploration robots and astronauts can collaboratively investigate the lunar surface, including researching the geological composition of the Moon for gaining insights into space conditions (Figure 7).

Mining robots are aimed at supplying resources for converting processable lunar materials into an energy source. Leveraging the capabilities of mining robots is also a goal in obtaining water from polar regions and extracting oxygen from regolith.

Unmanned aerial vehicles can be employed for observations on the lunar surface and the depths of space. These vehicles also possess hydrogen-capturing capillary shells, enabling them to store hydrogen molecules. In this context, the use of autonomous technologies is of paramount importance.

g. Production

Diverse food sources with different characteristics can be cultivated using aquaponic and hydroponic systems to ensure the sustainable use of water resources. For this purpose, vertical farming areas have been designed at the central base. An enclosed greenhouse environment, illuminated with basalt glass and LEDs, is intended to be established. Additionally, plants recycle waste and convert carbon dioxide into oxygen, making them a vital component of the life support system. Furthermore, silk production from cocoon farming will be undertaken at the production center to generate silk protein. It is also contemplated to leverage 3D printing technology in the construction phase of this facility (Figure 8).

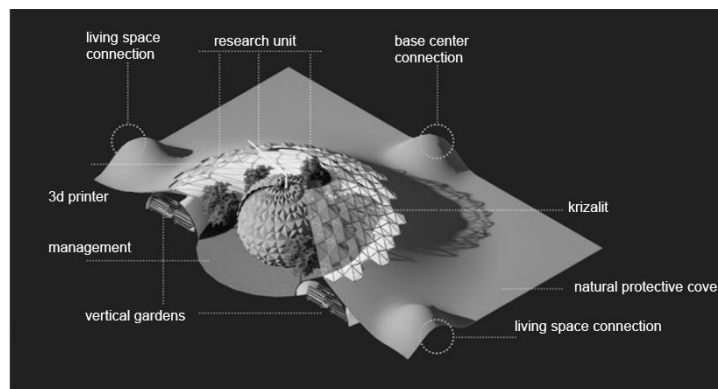


Figure 8. Lunar base production center graphic

h. Psychological Factors

Ensuring human adaptation to lunar conditions, both physically and psychosocially, is a fundamental criterion in the design of spaces to be established on the lunar surface. In this context, great care has been taken in the creation of spacious and open environments. Living spaces are designed with the intention of fostering a communal living culture by nourishing them with shared areas. This approach aims to facilitate social interaction among individuals and promote psychological well-being (Figure 9).

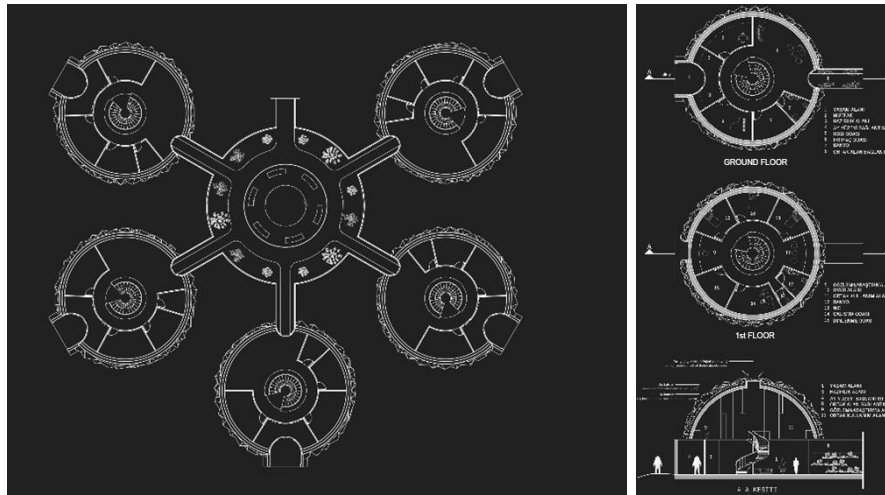


Figure 9. Layout and plans of cocoon structures

4. FINDINGS and DISCUSSION

In conjunction with the proposed designs for the lunar base, it has been recognized that construction using local materials from the lunar surface's resources can commence. In this context, 3D printers are expected to play a significant role in lunar operations where human resources are limited. With autonomous methods and the utilization of lunar regolith as a building material, it is evident that lunar-compatible structures can be established.

3D printing technologies have been found to play a critical role in the projects submitted for the Turkey Lunar Bases competition, as well as in internationally designed projects, for creating habitats on the Moon. Furthermore, considering international designs, it is believed that the proposed project for the Turkey Lunar Bases aligns with space conditions for achieving adaptability.

5. CONCLUSION and RECOMMENDATIONS

The Moon is at an important point in the search for life on different extraterrestrial planets. The Moon is used as a base to reach other planets. The Moon offers significant advantages in terms of lower gravitational force compared to Earth for interplanetary transportation. Moreover, beyond its utility as a base, it is evident that living habitats can also be established on the lunar surface. It has been concluded that 3D printing technology is one of the most crucial elements for production and establishment on different celestial bodies. Autonomous methods can leverage 3D printing technologies in the initial phase of construction necessary for sustaining life on various planets.



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Simultaneously, concepts have been generated to facilitate the adaptation of humans to extraterrestrial living environments both physically and psychologically. The role of 3D printing technologies in the production and construction phases of these concepts is substantial. It is believed that the projects proposed for the Turkey Lunar Base Idea Project Competition could serve as guiding steps for our country in the field of space exploration.

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**EXAMINING THE INFLUENCE OF RELIGION ON PLACE ATTACHMENT
THROUGH THE SHACK MOVIE**

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ABSTRACT

Human-space interaction is a cognitive process that exhibits various interactions depending on behavioral situations. In this sense, the theory of place attachment describes how memories, emotions, ideas, and personal preferences influence a person's sense of belonging to a place. In this context, the aim of the study is to examine the important role that religion can have in the context of place attachment from a different perspective through a movie. The findings of the literature review indicate that the majority of research in the domains of architecture and interior architecture mostly concentrates on secular spaces, with a lack of studies examining religious spaces. Contrary to the limited research in the literature, the relationship between religious places and place attachment is illuminated by many indicators depicted in films. From a different viewpoint, the film analysis approach has been used to investigate the impact of religion on place attachment, as it is believed that the research has the potential to make valuable contributions to the existing literature. In the study, the movie "Baraka", which was produced in 2017, was considered. Through the events and dialogues in this film, in which different natural and physical environments are handled, the concept of place attachment has been analyzed comparatively with the existing literature, and its relationship with religion has been revealed. Based on a comparative analysis conducted with the existing literature, it has been observed that an individual's place attachment is influenced not only by the inherent characteristics of the place itself but also by various factors such as prayers, rituals, stories, symbols, personal experiences, and beliefs associated with the place.

Keywords: Place Attachment, Religion, Sacred Places, Architecture, Movie Analysis.

1. INTRODUCTION

Human-space interaction is a cognitive process that exhibits various interactions depending on behavioral situations. In this sense, the theory of place attachment describes how memories, emotions, ideas, and personal preferences influence a person's sense of belonging to a place.

In recent years, there has been a growing interest in the study of people's attachment to places (Mazumdar & Mazumdar, 1993). In this context, the study aims to examine the important role that religion can have in the context of place attachment from a different perspective through a movie.



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When the literature on place attachment is examined, it is seen that most of the studies focus on secular spaces and environments; the role of religion, sacred space, and place attachment studies is largely ignored (Mazumdar & Mazumdar, 2004). It is thought that religious places, places of belief, and sacred places should also be included in the literature on place attachment.

Place attachment can be associated with a sense of security, protection, and familiarity based on a sense of belonging and well-being (Fullilove, 1996) and feelings towards a place that often develop around past experiences (Bowlby, 1973).

Sense of place is derived from the use of all human senses, such as sight, hearing, touch, and smell (Lynch, 1962); it also refers to place attachment, human attachment, and love of place because topophilia is the emotional bond between people and place or environment and is pervasive in concept and vivid and concrete in personal experience (Tuan, 1974). Some places are more important than others because of their physical characteristics and the types of activities that take place there (Ruback, Pandey, & Kohli, 2008). Place can be intimately known, loved, and internalized in personal, religious, and cultural narratives, even if one has never physically been in a particular place that is longed for or imagined (O'Donnell, 2017).

W. Robertson Smith, in his 1907 work *The Religion of the Semites*, refers to the analogy between the lives of the first inhabitants of these lands and the lives of their gods:

"...the nomadic shepherd or the wild hunter has no fixed home and cannot imagine that his god has a home either, but he has a territory or area where his wanderings are usually limited, and within that territory he has his favorite dens or campsites. And on the basis of this analogy, he chooses for himself the sacred lands frequented by the gods, and the special spots within these lands where the god is particularly moved. In time, under the influence of the god and settled life, the sacred land becomes the property of the god and the special sacred spots within it become his temples (Smith, 1907)."

People perceive places differently because places have different material, social, and symbolic aspects; individuals have different backgrounds, experiences, and reasons for being in places (Ruback, Pandey, & Kohli, 2008). Mazumdar & Mazumdar (2004) argue that religion can have a profound impact on people's relationship with space through the architectural design of cities, neighborhoods, houses, and sacred buildings. They even argue that religion makes some places sacred by attributing symbolic meanings to them and that sacred buildings also strengthen social bonds.

Religions, constructed as cultural traditions by people for people, need spaces just as the human body needs a space. Holy places are therefore very human things. Places can become sacred not only because of religious texts or religiously significant events but also because of the intensity of human longing, prayers, and even battles fought for them. Each part of the experience of a sacred space increases its significance for the communities that recognize it as sacred. Sacred sites are therefore expressions of the hopes and fears of communities that aspire to be rooted in history, a community, and a territory (O'Donnell, 2017). Sacred places in religion are places of prayer, veneration, meditation, and education. Through their design, décor, and aesthetic value, these sacred spaces help to bring people closer to religious ideals, spirituality, society, and place. Ranging from elaborate and ornate structures to simple roadside shrines, remote cemeteries, and quiet monasteries, these spaces celebrate the sacred, inspire awe, and



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inspire respect. The emotions experienced and expressed are largely influenced by the characteristics of the place, which helps to bind the believer both to the place and to the religion itself. For this reason, place is an integral component of many religions, and religions can play a major role in the development of place attachment. Furthermore, religion not only ascribes symbolic meaning to place, expressed through its physical location, architectural design, layout, and aesthetics, but also actively engages believers to experience history and geography (Mazumdar & Mazumdar, 2004). Visitors' experiences at religious heritage sites can be influenced by both objective environments and subjective interactions. The physical features of sacred places, such as the symbolic and emotional properties of religious buildings, statues, and rituals, create a powerful atmosphere that associates individuals with a god or gods (Huang, Pearce, & Wang, 2019). Place rituals are defined in religion as a series of actions through which places are repeatedly invoked, their sacredness is reaffirmed, and one's identification with the place is reinforced (Mazumdar & Mazumdar, 2004).

Mazumdar & Mazumdar (2004) argue that place can be an integral part of religion, and religion can play an important role in the development of place attachment. Place and space characteristics are important in religious place attachment. People develop attachments to sacred cities and sacred buildings, as well as natural places.

While the characteristics of a place can inspire and foster connectedness, spirituality, community, and peace, a person's connection to a place is not solely dependent on the characteristics of the place and can be learned through the process of religious socialization. In this context, important religious others, such as parents, educators, and peers, as well as the wider community of believers, can play an important role in identity formation, teaching through prayers and rituals, stories and symbols, as well as personal experiences of place (Mazumdar & Mazumdar, 2004). Environmental perception depends not only on the information available in the environment but also on the characteristics and actions of the perceiver (Ruback, Pandey & Kohli, 2008). As Mazumdar & Mazumdar (2004) point out, individuals can become attached to a place because a larger group to which they belong can make them believe that the place is important through collective activities such as prayers. In addition to this symbolic aspect, sacred places are important because religious socialization takes place there in the form of ritual, pilgrimage, and experience. Religion connects people to places through sacred acts, and these places connect people to religion because they are places where religion is learned and lived (Mazumdar & Mazumdar, 1993). The concepts of relationships and connectedness are important components of visitors' religious experiences at sacred places (Huang, Pearce & Wang, 2019).

The ideas of both 'sense of place' and 'place attachment' have been revitalized in the last decade with the emergence of non-representational approaches to embodiment, practice, and performance as concrete issues (Thrift, 2008). In this period of renewed intensification of work on the concept of place attachment, the book *The Shack*, which constitutes the fieldwork, was written simultaneously and later adapted to the big screen. Through this movie, a study was conducted on the effect of religion on place attachment.

2. MATERIALS and METHODS

The findings of the literature review showed that the vast majority of research in the fields of architecture and interior design focuses on secular spaces, while studies examining religious spaces are limited and scarce. In contrast to the limited research encountered in the literature,



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the relationship between religious spaces and place attachment is revealed through many indicators depicted in movies. From a different perspective, the film analysis approach was used to investigate the impact of religion on place attachment, as the research is believed to have the potential to make valuable contributions to the existing literature. In the study, the 2017 movie "Baraka" was analyzed. Through the events and dialogues in this film, which deal with different natural and physical environments, the concept of place attachment was analyzed in comparison with the existing literature, and its relationship with religion was revealed. Henri Lefebvre (2014) stated that "space is never empty; it always contains a meaning" and that space is a tool to tell a subject and convey a message. With this in mind, space, which is one of the tools used to tell the subject in cinema, can give sub-messages directly or contextually with the way architecture is used. Cinematic spaces are created by bringing physical and experienced spaces to the screen in relation to and in connection with the art of cinema (Çam, 2016). While cinema is an environment in which an architectural design that does not exist in reality and is created as an imagination can be used, it can also be considered an art with methods that can leave an experiential perception for the audience about the existing architecture (Aksoy, 2010).

Considering the limited literature on sacred places and the approach to the subject, an analysis in light of the studies conducted by Mazumdar and Mazumdar (1993, 2004) was deemed appropriate.

3. FINDINGS and DISCUSSION

*"Who wouldn't be suspicious if a man claimed to spend the whole weekend with God?
In a shack..." (Hazeldine, 2017)*

The Shack (Young, 2007), a novel that William Paul Young wrote in 2007 and that director Stuart Hazeldine adapted for the big screen in 2017, tells the tale of a father going on a spiritual journey. The main character of the movie Mack is on vacation with his family when his young daughter Missy, is kidnapped and brutally murdered in a shack in the forest. Deeply grieving, one day Mack receives a mysterious letter signed by "Father", God, and is summoned to the shack where his daughter was murdered. Mack, whose religious faith has been weakened by the events of his childhood and who has no heartfelt connection with God, goes to the shack and spends a weekend with God.

In the study, the scenes in the movie were grouped and analyzed under three main headings. These were grouped as *Church Scenes*, *Shack Scenes*, and *Nature Scenes*, and they were organized according to the flow of the subject, not chronologically or in scene order.

Church Scenes

The first church scene in the movie takes place in Mack's childhood. We see that the church, which is located in a rural area, has been transformed into a customized space in an open and natural area by simply covering it and placing movable furniture inside.

In the scenes shown in Figure 1, Mack, who has not yet lost his faith in God, talks to the priest in order to reach God and complains to God about his father, who is one of the elders of the church, for his violence against him and his mother. Because his father is known and respected by everyone in the church, he thinks that Mack has disgraced himself, so he makes Mack read verses under a tree in the rain after church and commits violence against him. After this complaint to the priest, Mack loses some of his religious beliefs because he cannot get a positive



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response from God. Mack, who is also responsible for the death of his father, has been carrying this burden throughout his life and has always been distant from religion and the church. The other two church scenes (Figure 2) in the movie focus on the present day and take place in a church in the city center.



Figure 1. Church scene

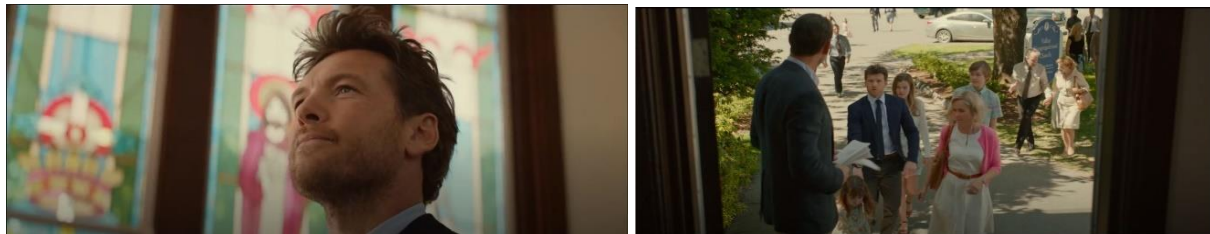


Figure 2. Church scene

These scenes show Mack before and after the death of his little daughter Missy, which deeply hurt Mack; in other words, before and after Mack met God. When we look at the church scenes that take place before Mack loses his daughter and meets God, we can see that Mack comes to the church every week with his family, but he only visits the church; he does not participate in the rituals there, and there is no sense of belonging or attachment between him and the church.

If we look within the space; at the beginning of the scene, we can see that the people who come to the church actually use the church as a meeting point, and later, as an example of the social development of the place attachment of religion, we can see that everyone who comes to the church sings together and socializes here. These rituals of place in this scene are actually defined as a series of actions through which places in religion are recalled over and over again, their sanctity is reaffirmed, and a person's identification with place is reinforced (Mazumdar & Mazumdar, 2004). In the scene (Figure 1), which takes place before Mack's meeting with God, Mack does not participate in the rituals performed in the church in spirit, even though he is physically present there, because he has not fully completed his religious belief, and unlike the others, he does not feel and internalize place attachment. Place rituals can play an important role in this internalization process. For this reason, place rituals function as reminders that inform and transform believers. Reminders can take the form of daily prayers and/or prayers on special occasions, as the movie also shows.

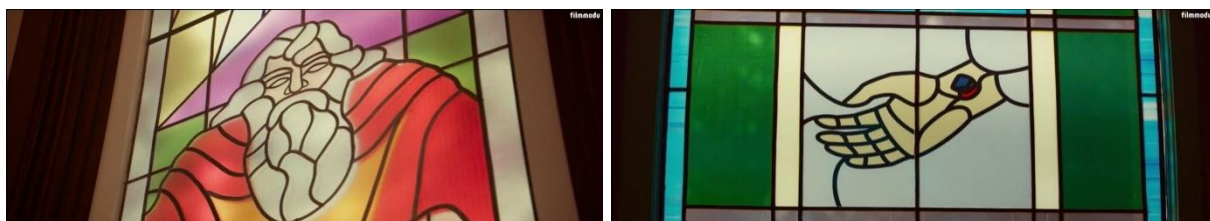


Figure 3. Stained glass windows in the church

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Another remarkable point in the scene (Figure 3) is the focus on two different stained glass windows in the church. In these stained glass windows, which are preferred in churches to make worship more mystical and ritualistic, one shows God and the other shows a cut, bleeding hand and the pain coming from it. The last church scene (Figure 4) in the movie takes place after Mack has met God and forgiven both himself and his daughter's murderer. In this scene, we again see everyone who comes to the church singing together with great enthusiasm, but this time Mack sings along with great sincerity and conviction, and church now means something else to him. After the last church scene, the film again focuses on the stained glass Windows (Figure 5). This time three different windows are shown. One of them is God, one is Jesus and one is the Holy Spirit.



Figure 4. Church scene



Figure 5. Stained glass windows in the church

It is possible to see alternative representations of traditional Christianity, spiritual ideas and teachings in the movie. The biggest example of this is the figure of God. The figure of God is presented as three different human (trinitarian) characters. The main god, the "Father", is a matriarchal, African-American, middle-aged woman associated with the house/hut space; "Jesus" is a young man from the Middle East, engaged in woodworking; and "Holy Spirit", also known as Sarayu, is an Asian, young woman engaged in gardening. Through these characters, the viewer is made to believe that the figure of God is not sexist, racist, or discriminatory.

Shack Scenes

The first shack scene (Figure 6) in the movie is the one in which Mack's little daughter Missy, who is always depicted as snowy, cold, gloomy, rundown, and broken down throughout the movie, is brutally murdered.



Figure 6. Shack scene



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Mack, who is not yet a religious man, receives a mysterious letter signed "Father" that brings him to this shack, where he falls asleep and suddenly finds himself in the woods. Mack meets Jesus in the woods and brings him to a beautiful, well-kept, cozy shack (Figure 7). Here Mack meets God, the Holy Spirit, and the person he later learns is Jesus. Mack's religious beliefs start to form after this scene, along with his questioning about religion.



Figure 7. Shack scene

If a comparison is made between the hut where Mack's daughter was killed and the shack in the woods where God (Figure 8), Jesus, and the Holy Spirit live, the shack where Missy is killed is always shown as black, dark, cold, and gloomy. The other shack, on the other hand, is depicted as well-kept, warm, and green throughout the movie. This actually shows us Mack's inner guilt, pessimism, and anger, while at the same time showing his goodness, beauty, and faith in himself. In other words, this comparison is actually emphasized in the film as summer/winter, heaven/hell, good/evil, goodness/evil in him/evil in him.



Figure 8. Comparative shed scenes

Nature Scenes

When we look at the movie in general, we can see that places of belief are constructed in open spaces rather than closed spaces. Nature has the ability to be imbued with spiritual power and significance. Forests, lakes and mountains often evoke a sense of the divine or sacred and inspire a sense of awe. Nature is a resource that people can use to connect with the sacred and create spiritual feelings. Moreover, people often have a moral perspective that envisions the natural environment as sacred, either because it is a divine creation or because it is inherently sacred (Ferguson & Tamburello, 2015).

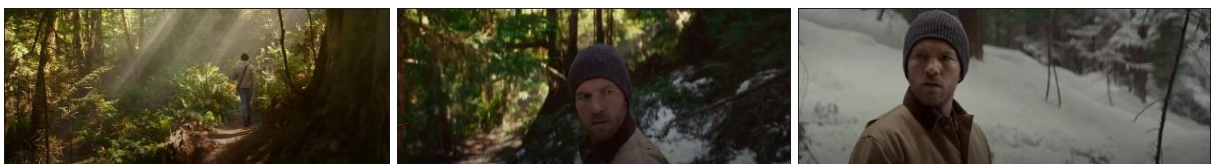


Figure 9. Nature scenes



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As Mack leaves the shack and walks with Jesus through the cold, snowy forest, he is suddenly transported to a lush spring forest of colorful flowers (Figure 9). As he follows Jesus, he leaves the cold, dark places in his past and in his soul and sets out on his own journey of faith. The comparisons made in the scenes of the cabin and the shack are also made in the forest scenes.

Another of the nature scenes that are frequently featured throughout the movie is the depiction of the Garden of Eden (Figure 10). The Holy Spirit takes Mack to a garden. Mack is very impressed by this garden, but states that he finds it quite complicated and disorganized.



Figure 10. Nature scenes

Then the Holy Spirit says that he wants to cut down a plant because he wants to plant something very important and asks Mack for help. Mack can't understand why this perfect plant has to be uprooted, but he helps him to do it. The next day what will be planted here will actually be her daughter's grave. Forgiving himself and his daughter's murderer, Mack is reunited with his daughter by God and has the chance to bury her. And his daughter will continue to live as a tree of life in the Garden of Eden. Thus, for Mack, who leaves a part of himself there, the sense of belonging and attachment to place becomes stronger.

At the end of the scene, we see a bird's eye view of the garden area (Figure 11), which Mack finds complex and disorganized. In fact, the emphasis that there is an order in every chaos and that God is the designer of this order is made with the help of fractals, which are a modeling of nature. The garden with these fractal elements constitutes a depiction of the Garden of Eden for Mack, whose religious beliefs are beginning to form. According to Briggs and Peat (2001), nature, that is, life, shows a non-linear structure that includes periods of stagnation, fluctuations and sudden jumps. In other words, fractals are new ways of interpreting the world.



Figure 11. Tree of life and fractals

During the weekend with God, Mack enters many different natural environments and experiences some fantastic supernatural events. These supernatural events include walking on the sea, passing through a rock, or seeing his daughter in heaven through a waterfall (Figure 12). After experiencing these things, Mack forgives himself and his daughter's murderer within himself and gets free.

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Figure 12. Supernatural events

Mazumdar & Mazumdar (2004) presented a conceptual model to understand the complex links between religion, place, identity, and commitment. This model consists of three main headings: place and its physical characteristics, religious socialization, and individual and collective commitment.

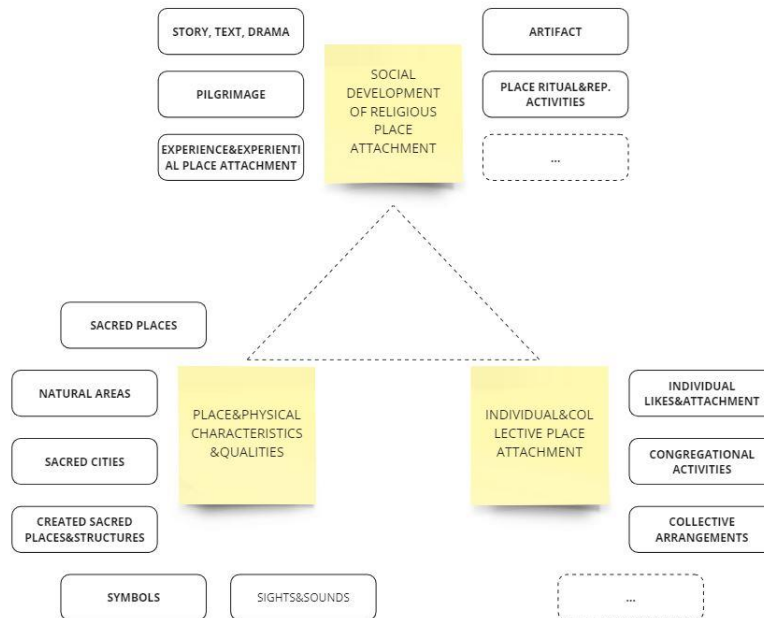


Figure 13. Religious place attachment: a model proposal (revisited from Mazumdar & Mazumdar, 2004).

The first heading, space, can be on a micro scale, such as houses, altars, shrines, tombs, cemeteries, temples, synagogues, mosques, or on a macro scale, such as regions or cities. They can also be places in nature, such as mountains, hills, lakes, rivers, rocks, or remote rural areas. The importance of places may stem from the qualities of the place, place-centered sacredness, or person-centered sacredness. Religion not only distinguishes these places from ordinary places by attributing symbolic meanings to them, It also has the potential to foster commitment, devotion, spirituality, disposition, morality, and worldview through its geography, design, or architectural aesthetics. The second heading, religious socialization, focuses on how attachment to religious space is taught and learned through phenomena such as ritual, story, text, drama, experience, and pilgrimage. The final strand of the model includes individual and collective components. Individuals acting collectively may develop a strong attachment to places that religion considers important or that the collective considers important. Likewise, individuals may develop individual attachments to religious places. Individuals may feel a stronger



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attachment to a particular place or structure than others in that religion or collective, and in some cases, this attachment may be less intense or absent for an individual. Figure 13 shows the analyze of this conceptual model through the movie.

When we look at the title of location, physical characteristics, and qualities, we can see that sacred places in the movie are given together with frequently encountered natural areas. These sacred places include mountains, lakes, rocky areas, and rural areas, as well as depictions of the Garden of Eden and symbols such as the tree of life. In addition, examples of sacred structures are given with church scenes.

When we look at the social development of attachment to religious space, we see depictions of close friends talking and joking with each other in the church entrance scene and meeting in church every week as a ritual, everyone singing together in church, or church as a place where the family gets ready with great enthusiasm and goes to church.

When we look at individual or collective place attachment, we see that the movie includes both collective religious rituals and individual prayer scenes. It is also clear that in church scenes, individuals may feel a stronger attachment than others in the collective, and in some cases, this attachment may be less intense or absent for an individual.

4. CONCLUSION and RECOMMENDATIONS

It is clear that studies in the disciplines of architecture and interior architecture have hardly ever examined the issue of place attachment in sacred spaces, which is a topic that many disciplines address from various angles. Studies in the field of environmental psychology are somewhat more prevalent, but they are not sufficiently numerous. It is thought that conducting future studies in different scopes and addressing different disciplines will enable the enrichment and elaboration of the data obtained as a result of this study area.

When the literature on place attachment is examined, it is seen that most of the studies focus on secular spaces and environments. It is seen that the role of religion, sacred spaces, and place attachment studies is largely ignored. It is thought that religious places, places of faith, and sacred places should also be included in the literature on place attachment.

The findings of the comparative study conducted with the available literature and the film under examination indicate that environmental perception and the idea of place attachment are not just influenced by the individual user and the unique attributes of the location, but also have additional factors at play.

- The concept of place attachment is also related to place and religion, and it is inevitable that religion influences place and place influences religion.
- Additionally, a variety of place-related factors, such as prayers, rituals, stories, symbols, individual experiences, and beliefs, have an impact on them.
- Religious others (parents, educators, peers, etc.) and the community of believers can play an important role in identity formation.
- Personal experiences of place, subjective values and situations, relationships with faith, emotions, and spiritual values can also be effective in place attachment.



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TRANSFORMATION FROM WASTE MATERIALS TO DESIGN

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ABSTRACT

The concept of recycling has been around for decades, but its importance has become more apparent in recent years as we face environmental challenges such as climate change and resource depletion. Recycling is the process of reusing and reusing materials that helps reduce waste and conserve natural resources. Recycling has become an important component of product design and DIY as it helps support sustainability and reduce our impact on the environment. One of the benefits of recycling in design is the use of recycled materials. By using recycled materials in product design, companies can reduce their environmental footprint and conserve natural resources. Today, priority is given to recycled products not only in product design but also in facade design and even in art. However, recycling in design in general also has its challenges. One of the main challenges is finding reliable sources of recycled materials. Companies struggle to find consistent sources of recycled materials. While governments can offer incentives and support to companies that use recycled materials in their products, individuals can make a conscious effort to purchase recycled products and incorporate recycling into their projects. As a result, recycling plays a crucial role in promoting sustainability in design. Individuals and companies can reduce waste, conserve natural resources and encourage creativity and ingenuity by using recycled materials and incorporating recycling into their projects. With education and awareness, we can all play a role in promoting recycling and creating a more sustainable future.

Keywords: Waste Material, Recycling, Design, Product Design, Facade Design.

1. INTRODUCTION

It is the case that short-lived items turn into waste objects when the use time is over, that is, when the item becomes old and the state of usefulness disappears. The shortening of the use time of the goods has become more pronounced with the introduction of mass production completely depending on industrial developments. Mass production has developed in the age of industrialization, and accordingly, a disposable consumption style has emerged in post-industrial societies. Thus, it is seen that the so-called 'waste object' has come to the agenda with modern life (Yılmaz, 2015, 186).

The concept of waste refers to "all kinds of substances and materials that are not used, are not intended to be used, do not have any value and are thrown out". Wastes are generally classified as solid wastes, liquid and gas wastes, packaging wastes, and "substances that do not contain enough liquid to be fluent, should be disposed of in a way that does not harm human and environmental health, and do not work" are defined as solid waste. According to the sources, there are many recovery and disposal methods for solid wastes classified in four groups: domestic solid wastes, industrial qualified solid wastes, medical solid wastes, special solid



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wastes. These can be sorted as reuse, recycling, recovery, incineration, composting, storage (Tandoğan, 2018, s.190).

Reuse is the reuse of waste in the same way "without undergoing any treatment other than cleaning". Recycling "is the introduction of waste into the production process as a second raw material after it has been subjected to physical and/or chemical processes". Recycling, on the other hand, is the process of using more than one by "converting the components in it to other products or energy by physical, chemical or biochemical methods by taking advantage of the properties of waste, including the concepts of reuse and recycling" (Tandoğan, 2018, s.190).

2. MATERIALS and METHODS

In this section, the study method, the model, universe and sample of the research, data collection techniques and data analysis are included.

In this research, while theoretical information about the subject is reached through literature research, limitations related to the subject have been introduced with the data collection tool developed specifically for the subject.

3. FINDINGS and DISCUSSION

As the world continues to face environmental challenges, it has become increasingly important to focus on ways to reduce waste and promote sustainability. Recycling is one of the most effective ways to achieve these goals and has the potential to radically change the way we think about product design and Do-It-Yourself.

It is possible to reuse building materials that have reusable qualities in various areas. The reuse of waste building materials is the recovery method with the highest resource and environmental protection due to the fact that it does not require any energy consumption. Structural wastes that are not suitable for reuse are also subjected to a number of recycling processes and are returned to sectoral applications. The structures built using these materials have a positive impact on the country's economy and sustainability (Çuçen & Altuncı, 2022, 193).

Recycling is the process of converting waste materials into new products. By recycling, we can reduce the amount of waste sent to landfills and incinerators, protect natural resources and reduce greenhouse gas emissions. When it comes to product design, there are a number of important benefits of recycling:

1. Reducing waste: By using recycled materials in product design and do-it-yourself projects, we can reduce the amount of waste that goes to landfills and incinerators. This helps to protect natural resources and reduce the environmental impact of our actions.

According to the information obtained from the research, policy makers are carrying out activities to increase the participation of the public in recycling activities, to inform and convince the public. The basic assumption that drives these activities is the fact that recycling will benefit the environment. However, it is not possible for administrations to maximize the benefits of recycling without realizing its potential negative consequences. For this reason, it is very important to go to waste reduction in recycling information studies and to explain the possibilities of reuse to individuals (Tufaner, 2019, 34).

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2. Protecting natural resources: Recycling helps protect natural resources such as timber, minerals and water. By using recycled materials, we can reduce the need to extract these resources from the earth, which help protect natural habitats and ecosystems.

Waste has been expressed as the difference between the amount of resources owned and the amount needed Decently. Waste arises from the use of more resources than necessary or the inefficient use of resources. In everyday life, most individuals knowingly or unknowingly waste resources and damage natural resources. Therefore, the reduction of feelings related to wasteful consumption comes across as a process that precedes recycling activities (Tufaner, 2019, 34).

3. Reducing greenhouse gas emissions: Recycling also helps to reduce greenhouse gas emissions. When materials are recycled, it requires less energy than producing new materials from scratch. This means burning fewer fossil fuels, which helps reduce the amount of carbon dioxide and other greenhouse gases released into the atmosphere. Tue.

4. Promoting sustainability: By incorporating recycling into product design and Do-It-Yourself projects, we can promote sustainability and raise awareness of the importance of reducing waste and protecting natural resources. This can inspire others to take action and make sustainable choices in their own lives.

Jul Jul can contribute to waste management through information and awareness-raising activities in order to contribute to the country's economy in an effort to leave a sustainable clean environment and a clean world to future generations, especially with recycling that will suppress the feeling of extravagance. Especially in order to suppress the feeling of extravagance, it can contribute to waste management through information and awareness (Tufaner, 2019, 34).

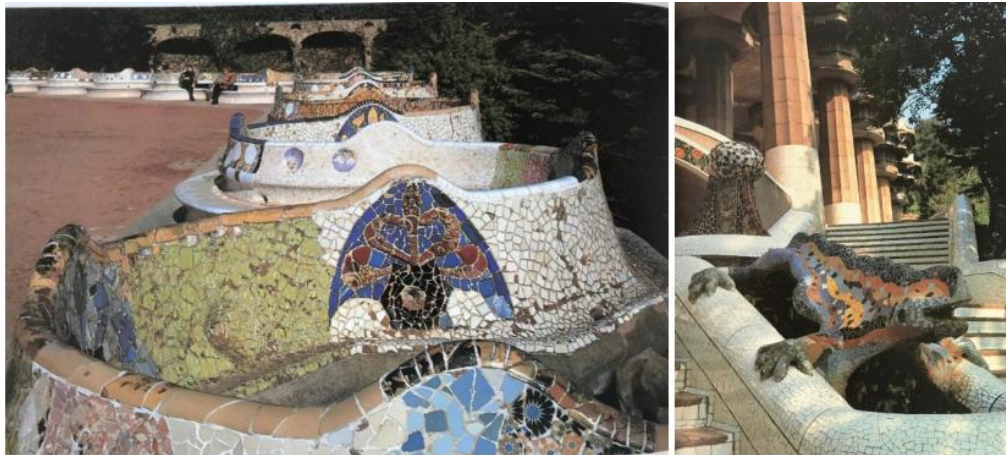


Figure 1. Güell Park, Barselona-Spain, 1926 (Küplemez & Güngör, 2023, 48).

Gaudi used ceramic materials to be close to people and nature and achieved an artistic appearance with thousands of broken ceramic pieces. At the same time, the bench is both waterproof and health-friendly because it is covered with mosaic. One of the reasons Gaudí prefers ceramic material is that ceramic material is economical. Gaudi obtained the ceramics he used by using the waste parts of faulty products produced in factories. Color plays an important role in Gaudí's designs. Ceramic material offers convenience in providing a variety of colors and is also preferred due to its durability (Figure 2) (Küplemez & Güngör, 2023, 48).

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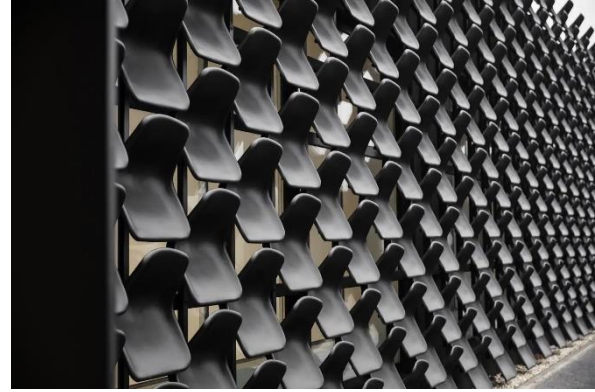
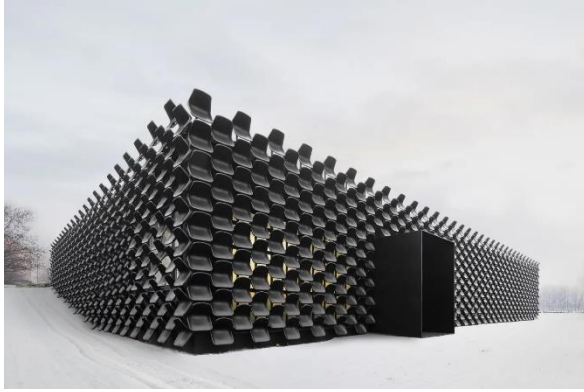


Figure 2. Chybik+Kristof Architects & Urban Design, Brno, CZ, 2015-2016 (www.chybik-kristof.com, 2023)

The new furniture showroom is located on the outskirts of a public housing estate in Brno. The existing building was not suitable for the proposed function from a formal point of view. There are two sides to the concept; the first involves working with the interior and focusing on the presentation of a wide range of products that the company produces or distributes. The spacious interior is divided into sections by a system of spaces defined by suspended curtains. The second side of the concept solves the design of personnel facilities, consisting of offices, warehouses and technical and sanitary facilities. The new outdoor shell consists of the structure of the chairs produced by the company (<https://www.chybik-kristof.com/projects/gallery-of-furniture>, Erişim tarihi:17.07.2023).



Figure 3. Endless chair, Dirk Van Der Kooij, 2011 (dirkvanderkooij.com, 2023)

In 2011, the Endless chair was realized as Dirk van der Kooij's challenging graduation project. In a world first, he had reconfigured a pneumatic robotic arm to remove furniture from recycled plastic. The first series consisted of lightly colored plastic threads, shakily formed to form 3-D tapestries. A misaligned motor was creating a fistulous pattern, but it was also responsible for an unexpectedly veiled use of the technique (<https://dirkvanderkooij.com/endless-chair>, Erişim tarihi:13.07.2023).

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One way to incorporate recycling into product design is to use recycled materials in the manufacturing process. This could include using recycled plastic, paper and metal to create new products. Many companies are already doing this, and it has become an important trend in the manufacturing industry.



Figure 4. Sculptural Design, Charlotte Kidger (www.charlottekidger.com, 2023)

Kidger is a London-based producer who researches how industrial waste materials can be reprocessed and transformed into sculptural and functional objects. Their furniture and home accessories are made of polyurethane foam powder, which is a waste material of creating industrial-scale 3D models on CNC machines, and hand-painted resin, which is cold poured into molds.

"Designers are starting to see waste as a new form of raw material due to the extraordinary volumes of various waste streams that surround us," he says. "Companies with materials that have no residual or residual value will have to install systems to ensure that these materials enter new production cycles."

Charlotte Kidger is a London-based UK Maker (b. 1992). Kidger graduated from Leeds College of Art BA (2014) and Central Saint Martins MA (2018) and has a background in Molding, Casting and Sculpture, based on industrial by-products. Her practice is led by a hands-on approach to exploring how these undervalued resources can be reused to reconnect people with our material world.

Often marrying unconventional sources and processes, he aims to reframe material values through carefully crafted works and installations. Ongoing research on material extraction, by-products and craft processes means that new ideas and concepts are constantly evolving. Charlotte hopes to bring alternative perspectives to new audiences through sensory experiences and storytelling (<https://www.charlottekidger.com/bio>, Erişim tarihi:20.07.2023).

4. CONCLUSION and RECOMMENDATIONS

Finally, we can summarize the key points we have mentioned and re-state the importance of recycling in product design. You can also offer some final thoughts or advice for readers who want to incorporate recycling into their own projects.

As a result, recycling is an important part of promoting sustainability and reducing waste. When it comes to product design, recycling has the potential to radically change the way we think about creating and consuming goods. By including recycling in our projects, we can help protect natural resources, reduce greenhouse gas emissions and promote a more sustainable future for everyone.



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AN ANALYSIS ON NATURAL AND ARTIFICIAL LIGHTING OF RELIGIOUS BUILDINGS: EDİRNE HASAN SEZAI MOSQUE

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ABSTRACT

Architectural lighting is one of the important elements that determine the atmosphere and user experience of a building. Light, beyond creating an aesthetic effect in the exterior and interior spaces of architecture, is a powerful tool that has various physiological and psychological effects on people. Today, architectural lighting has become a design element that not only improves the appearance of a building, but also affects the experience of the users. As people build their daily lives to benefit from daylight, it has the potential to affect daily mood, energy level and general health. The use of daylight, which is of great importance for living things, also adds quality and function to spaces. However, natural and artificial lighting in religious buildings; It is used as an effective tool to emphasize the spirit, spirituality and meaning of places. The aim of this study; The aim is to examine the use of natural and artificial lighting and design elements on religious places. For this purpose, Edirne Hasan Sezai Mosque has been determined as an exemplary building. The existing natural and artificial lighting scheme of the building was modeled and simulated in the Dialux Evo lighting program. As a result of the study, it was observed that the natural and artificial lighting values on the ground floor were compared with the standards, and it was observed that the brightness value in some prayer rooms on the first floor, which could not receive natural light directly, was not sufficient for natural and artificial lighting.

Keywords: Lighting Design, Lighting in Religious Buildings, Edirne Hasan Sezai Mosque.

1. INTRODUCTION

Structures designed to fulfill the spiritual requisites of individuals are commonly termed as religious edifices. The fundamental objective of religious structures is to congregate individuals of the same faith, establish a conducive milieu for worship practices, and concurrently augment the pervasive influence of the given religion. These architectural constructs exhibit distinct variations contingent upon the unique attributes intrinsic to each faith.

Within these structures, the provisioning of physical and visual comfort prerequisites is imperative for the facilitation of purposeful actions. The formulation of an apt lighting design is achieved through the amalgamation of factors encompassing the judicious utilization of suitable light sources, manipulation of color temperature, and regulation of luminous intensity. Consequently, the luminous ambience cultivated within interior and exterior spaces assumes a pivotal role in upholding individuals' circadian rhythms, consequently exerting an influence on



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the circadian systems governing diurnal patterns and endocrine secretions (Doğan, 2021, pp. 519-528).

2. MATERIALS and METHODS

This study notably underscores the necessity for accommodating visual comfort conditions within religious structures and accentuates the symbiotic relationship between the ethereal and mystical sentiments engendered by the architectural design and the quality of the illumination imparted. The primary aim of this investigation is to scrutinize the evolving role of technology in architectural design and dissect the simulation of both natural and artificial lighting within the architectural milieu using the Dialux Evo program. The overarching objective is to assess the adequacy of natural and artificial lighting within religious structures, preemptively discerning the essential prerequisites for artificial lighting within sacred worship spaces (Halıcıoğlu, Öztank & Vatanserver, 2007, pp. 28-33).

3. FINDINGS and DISCUSSION

3.1. Visual Comfort And Illumination Within Mosques

Sacred architectural environments wield the potency to evoke profound emotional and physiological responses in individuals, owing to the orchestrated interplay of symbolic and material constituents in spatial configuration. These edifices primarily facilitate congregational worship and spiritual practices among adherents unified by shared convictions and sentiments. In this context, the seamless alignment of the philosophical underpinnings of faith with the tangible architectural milieu is of paramount import, as it engenders a cohesive conduit for the nuanced transmission of abstract tenets into experiential reality. Illustratively, the diffusion of natural light through fenestral apertures encircling the dome within mosques serves a dual purpose: it not only furnishes requisite luminosity to enable visual discernment, but also exerts a congregative influence, compelling the assembly to convene beneath the dome while augmenting the perceptual resonance of both the dome and its encompassing space (Cengiz, 2022). This intrinsic harmony between the enduring canonical morphology of mosque architecture and the intricacies of illumination design embedded therein affords an avenue to amplify the immersive ambience for worshippers, thereby endowing the architectural entity with an augmented spiritual resonance (Durukan, 2017). The spectrum of activities conducted within mosque precincts, encompassing prostration, supplication, recitation, and audile engagement with the Quran, transpire within a seated posture, each demanding a nuanced gradient of luminous modulations. Furthermore, in the realm of mosque architecture, the ingress of light through zenithal apertures in the dome periphery commonly serves to orchestrate congregational dynamics, directing the assembly toward the sacred core beneath the dome. Simultaneously, light filtrating through lateral walls encircling the mihrab and apertures punctuating the dome coalesce to focalize attention and bestow requisite luminance upon the designated domain reserved for the imam (Ünver, 2000). The imperative illumination thresholds germane to the spectrum of activities manifest within the sacred confines of mosque spaces are tabulated in Table 1.



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Table 1. Proposed Determinations on Lighting Criteria in Mosques Inspired by Rengin Ünver's Work on Lighting and Religious Buildings (Demirkol, 2023).

Action Type/ Action Venue	Illuminance Measures		
	Illuminance	Luminous Quality	
	Illuminance Level (lm/m ²)	Action Plane (Position)	Illuminance Distribution
Reading	300	Yatay	Regional
Praying/ Mihrab (For the imam)	300	Vertical/ Horizontal	Regional/ Common
Praying/ Flooring	100	Horizontal	Common
Speaking/ Minbar	300	Vertical/Horizontal	Regionality

Internal lighting systems must inherently exhibit the requisite values and attributes outlined in the criteria provided in the table. In addition to general illumination, localized lighting is also essential to facilitate an enhanced perceptual understanding of the space. In the context of mosques, daylighting is primarily harnessed through numerous small windows present on the lateral walls and dome of mosques designed to benefit from natural lighting. However, the traditional load-bearing masonry construction technique employed in mosques often entails substantial wall thicknesses, thereby diminishing the luminous efficacy of natural light penetrating the interior space.

Concurrently, windows situated within the body walls of the mosque, generally commencing from an elevation proximate to the flooring level (approximately 0.40 m), contribute to providing essential luminosity for areas conducive to Quranic recitation, positioned close to the wall. Worship activities within the mosque, such as prayer and dialogue-listening, frequently occur upon the flooring surface, consequently, natural light entering through side windows augments the overall ambient luminance level (Direk & Oğuz, 2005). However, instances of inadequate or absent natural light have historically led to the utilization of artificial light sources such as candles, oil lamps, and the like within mosques. Typically suspended from various ceiling elements such as domes and vaults, these sources were often arranged in the form of pendant chandeliers or nested iron rings of varying sizes. Presently, analogous arrangements, featuring a height from the floor of approximately 2.5 meters, continue to be employed for artificial illumination within mosque interiors, now utilizing incandescent electric lamps (Oktaç, 1992). The ensuing section of the study addresses the fieldwork conducted, where the information presented in this section is comprehensively examined.

3.2. Field Study: Hasan Sezai Mosque in Edirne

In this study, the comprehensive exploration of natural and artificial illumination levels in religious structures was undertaken. The existing state of the structure was initially simulated, followed by a discussion on potential scenario alternatives.



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3.2.1. Location and Architectural Features of the Structure

Hasan Sezai Dergah is recorded to have been established in 1428. According to Badi's Hadayik-ül Haikaik Fi Tekmilet-ül Şekayik, the lodge, initially constructed with a wooden roof and a single minaret, was commissioned by Şah Melek Bey (d. 1441) and recognized as the 'Şah Melek Lodge' (Yöre Dergisi, 2003). As illustrated in Figure 1, the Dergah is situated southwest of the city, within the transitional area influencing the Talatpaşa Neighborhood urban conservation site (Benian & Mısırlı, 2020).

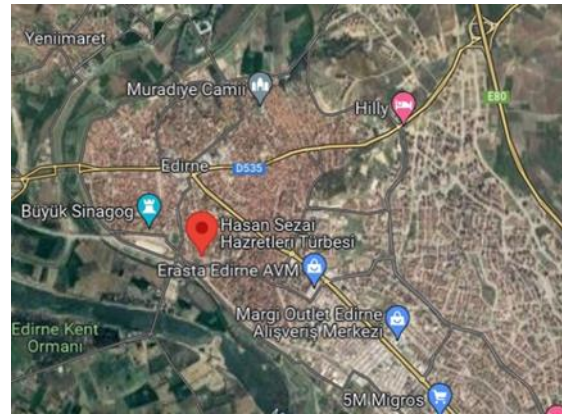


Figure 1: Urban location of Hasan Sezai Dergah (Google Maps, 2023)



Figure 2: View of the Dergah from the Garden (Demirkol, Burçin İrem Demirkol Photo Archive, 2023)

Hasan Sezai Mosque is positioned within the dergah, immediately to the right upon entering through the main entrance on Bostanpazarı Street, in front of Hasan Sezai Tomb. The structure exhibits a rectangular, two-story design (Figure 4 and Figure 5). Within it lies a rectangular gallery void, encircled on all four sides and demarcated by gallery floors supported by wooden columns (Benian & Mısırlı, 2020) (Figure 6-8).

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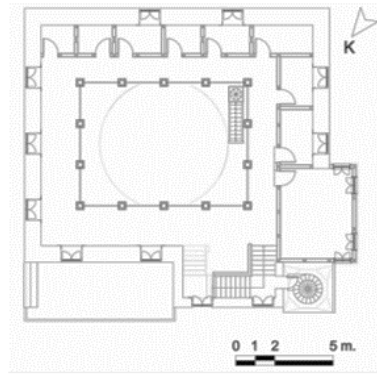
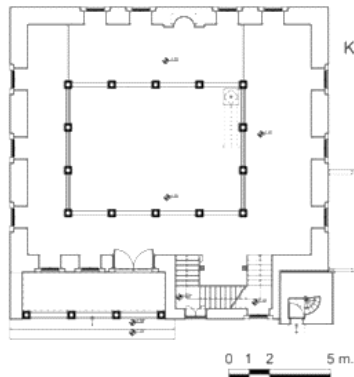


Figure 4. Ground floor plan **Figure 5.** First Floor Plan
(Regional Directorate of Foundations Photo Archive, Edirne)



Figure 6-7-8. Ground floor and balcony floor interior (Demirkol, Burçin İrem Demirkol Photo Archive, 2023)

At the upper level, instructional and worship spaces have been positioned within the gallery void, oriented towards the southern and western directions (Figure 9 and Figure 10).



Figure 9-10. Balcony floor prayer rooms (Demirkol, Burçin İrem Demirkol Photo Archive, 2023).

The western end of the façade terminates with a minaret, behind which an upper-level projection, known as a 'cumba', is situated. This area was originally designated as the 'Sheikh's



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room', and currently serves as a classroom. The structure is covered by a pitched roof, however, the interior of the roof features a 'bağdadi' dome. The mosque's façade exhibits a sequential arrangement of windows on both levels (Figure 11-13).

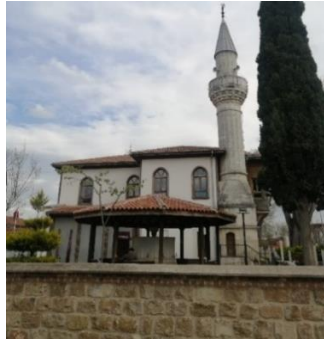


Figure 11. Mosque north facade



Figure 12. Mosque northeast facade

(Demirkol, Burçin İrem Demirkol Photo Archive, 2023)



Figure 13. Mosque southeast facade (Demirkol, Burçin İrem Demirkol Photo Archive, 2023)

3.2.2. Current Illumination Status of the Structure

The illumination within Hasan Sezai Mosque is derived from the window openings on the ground and gallery levels. The sequential arrangement of window openings around the ground level facilitates a maximal intake of daylight within the structure. However, sufficient illumination remains insufficient. Among the prayer rooms positioned along the edges of the gallery level, some feature window openings, while others lack apertures to the exterior. To address this, intermediary window voids have been introduced in rooms without direct daylight access, allowing for the transmission of natural light. Additionally, in certain linear rooms, intermediary windows have been integrated to capture natural light for rooms not directly illuminated by daylight, capitalizing on the illumination received by the third-row room through its window opening.



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Figure 17. Balcony level gallery void (Demirkol, Burçin İrem Demirkol Photo Archive, 2023)



Figure 18. Ground floor worship area (Demirkol, Burçin İrem Demirkol Photo Archive, 2023)

The Hasan Sezai Mosque features an interior adorned with a Bağdadi dome and a pitched roof covering, rendering the uppermost covering devoid of any window openings. Conversely, the mosque's design strategically guides daylight into the interior through lateral windows of the Bağdadi dome which is centrally planned, having two stories, a suspended ceiling, and an atrium, thereby bypassing the conventional openings of the dome. Furthermore, the mosque's white-colored carpets and walls enhance the reflection of natural light from the window openings, augmenting the internal luminosity (Figure 18).

On the ground floor, there are 13 windows, while the first floor comprises 7 windows, ensuring a direct intake of natural light into the worship area. Additionally, artificial lighting within the mosque is facilitated by lamps positioned at a height of 2.6 meters from the floor on the underside of the mezzanine. These lamps are thoughtfully placed along the middle of the windows to adequately distribute the illuminative effect of daylight within the space. In the worship area of the ground floor, artificial lighting elements are positioned within the walls between each window, while beneath the mezzanine, 11 lamps are situated in proportion to the lower floor, comprising 15 lamps along the walls. On the upper floor, the study and worship rooms are arranged along the south and west sides of the gallery void. Notably, there are no artificial lighting elements above the gallery void. The illumination for this area is provided by four lamps situated above the gallery void, encircling the first floor mezzanine. Each study and worship room on the first floor features ceiling-mounted lamps. Given the ample daylight that permeates the ground floor during the day, artificial lighting is dispensable. The worship rooms of the women's gallery, oriented towards the west, possess generously sized apertures that render artificial lighting unnecessary during daylight hours. In the southern sequence of worship

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rooms, those with direct exterior-facing window openings require no artificial lighting during the day. However, for those rooms without exterior openings, artificial lighting is necessary and provided throughout the day. A widely used lighting analysis program, Dialux, which is versatile and functional, was employed for lighting calculations. In the subsequent section, the mosque's lighting simulation and findings through the Dialux Evo program are elaborated upon.

3.3. Illumination Analysis of Hasan Sezai Mosque: Natural and Artificial

During the modeling process, the general structure was developed based on factors such as inter-floor height, wall thickness depth, height differences of window openings from the floor, the number, location, and height of artificial lighting fixtures, as well as the colors of materials used within the structure.

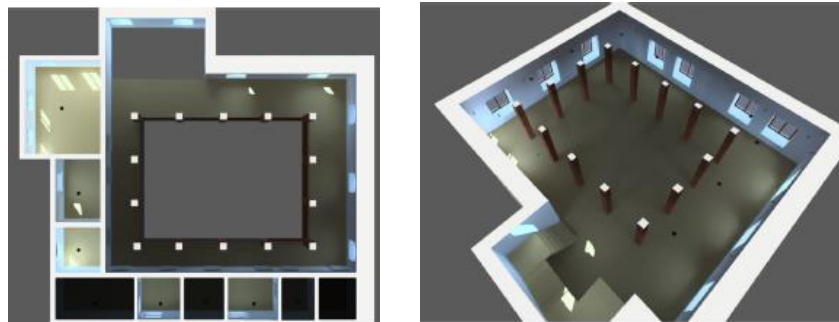


Figure 19-20. Hasan Sezai ground floor and gallery floor plan natural light modeling

In the daylight natural illumination simulation of the ground floor, an examination of the misrepresentation of colors (Figure 21-22) reveals that the worship area's flooring reaches values of 100, 200, and 300 lm/m^2 . The misrepresentation of colors showcases the distribution of illuminance ratios within the space through a color scale, corresponding to the materials and angles of incidence within the interior. The green-colored areas observed in Figures 20 and 21 correspond to values ranging from 100 to 300 lux. The distribution of illuminance on the wall surfaces is predominantly at the 100 lux level. Thus, this depiction allows for an understanding of the distribution of illuminance levels.

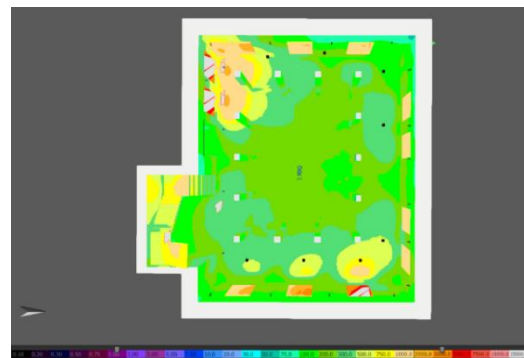
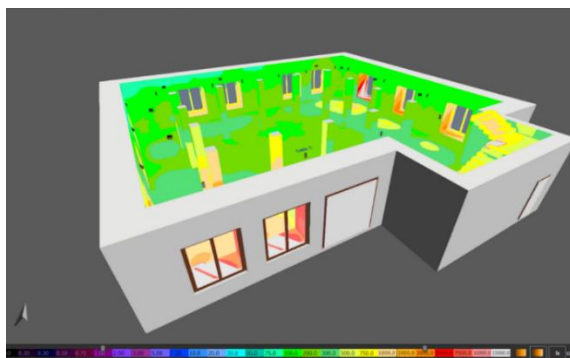


Figure 21. Ground floor natural lighting representation in perspective

Figure 22. Ground floor natural lighting representation on the plan

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In the daylight natural illumination simulation of the gallery floor, the areas adjacent to the window openings exhibit values of 100, 200, and 300 lm/m^2 . The region housing the balcony, situated at the same level as the teaching room and the worship room to the east, as seen in Figure 23 and Figure 24, is highlighted in orange to represent an illuminance value of 1000 lux. The central area displays an average illumination ranging between 100 and 300 lux. The distribution of illuminance on the wall surfaces is generally at the 100 lux level. The values indicated as green for the worship rooms in the southern region denote approximately 300 lux, while the values shown in blue represent 10 lux on the color scale. The areas of worship without windows exhibit significantly lower illuminance values. The illuminance level of the worship room depicted in purple, with an approximate value of 0.75 lux, is notably inadequate.

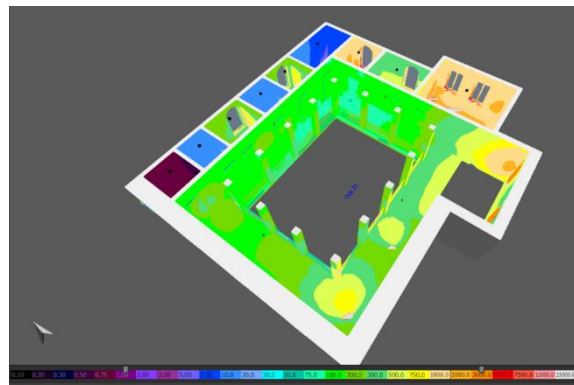
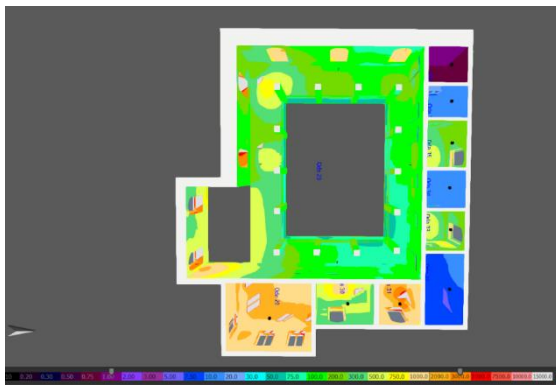


Figure 23. Balcony level natural lighting simulation
Figure 24. Balcony level natural lighting simulation

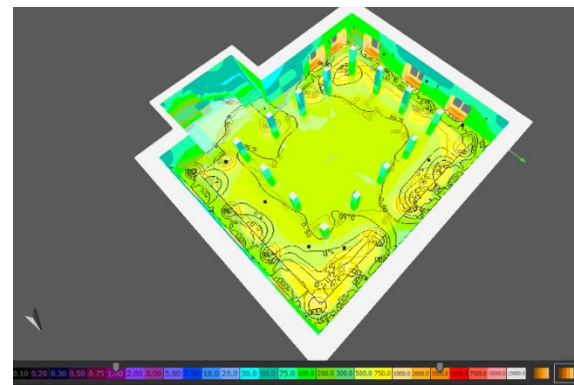
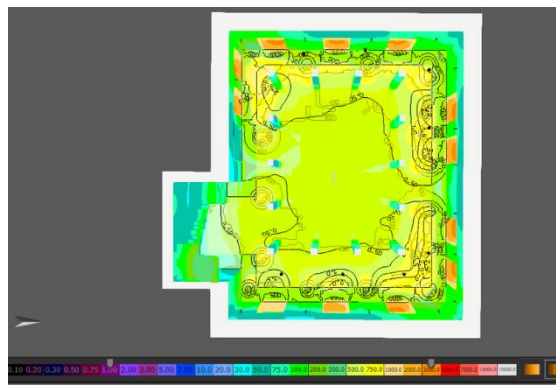


Figure 25. Incorrect colors display on the ground floor plan
Figure 26. Ground floor plan perspective incorrect colors display

In addition to natural lighting analysis, artificial lighting data has also been measured in the study. In the evening hours after sunset, in the artificial lighting simulation of the ground floor, the illuminance provided by the luminaires in the worship area, as depicted in Figure 25 and Figure 26, is reported to be approximately 108 lux in the lighting report (Figure 27).



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Hasan Sezai Camii						
Yapı 1 - Kat 1						
Işıklık listesi						
Φ toplam	P toplam	Işık verimi				
31895 lm	297.6 W	107.2 lm/W				
Adt.	Üretici	Ürün No.	Ürün adı	P	Φ	Işık verimi
8	Philips	DN140B ELB3 IA1 EM 1 xLED20S/830 C		3.0 W	280 lm	93.3 lm/W
15	Philips	PT320T 1 xLED175/827 MB		14.4 W	1709 lm	118.7 lm/W
4	Philips	PT320T 1 xLED175/827 MB		14.4 W	1005 lm	69.8 lm/W

Figure 27: Hasan Sezai Mosque ground floor artificial lighting report

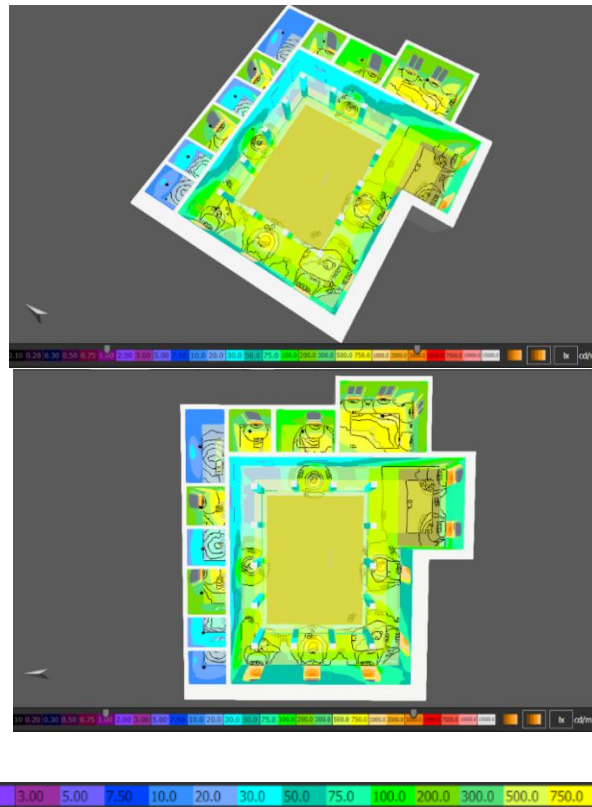


Figure 28. Balcony level incorrect color display

Figure 29. Balcony level incorrect color display

In the absence of daylight on the gallery floor, in a purely artificial lighting simulation, as seen in Figure 28 and Figure 29, it is observed that the illuminance level of the western area's bay-windowed lecture room and the two adjacent ordered prayer rooms falls within the range of 100-200 lux. For the row of prayer rooms in the southern area, rooms with window openings exhibit an average illuminance of 200 lux, while those without window openings are observed to have an approximate illuminance value of 70 lux.



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4. Evaluation and Conclusion

Natural lighting constitutes a significant factor influencing the atmosphere of religious structures. The quantity, quality, and direction of light influence the worship experience within spaces. In this study, the natural and artificial lighting values of Hasan Sezai Mosque were simulated using the Dialux Evo program for data analysis. In this context, the natural lighting potential of Hasan Sezai Mosque was assessed through an analysis of sun movement, employing simulations generated solely using daylight data. The results of the natural lighting simulation indicate an illuminance range of approximately 100-200 lm/m² for the ground floor prayer area. The observed natural lighting value on the ground floor aligns with references drawn from a limited number of studies in the field as identified through literature research (Ünver, 2000; DIB, 2021).

Interior Lighting Standard Values in Mosque Planning and Design (T.C. Cumhurbaşkanlığı Diyanet İşleri Başkanlığı, 2021).

Table 2. Interior Lighting Standard Values in Mosque Planning and Design Have Been Prepared by Inspired by the General Lighting Values of the Presidency of Religious Affairs and Rengin Ünver's Lighting and Religious Buildings (Demirkol, 2023).

Action Type/ Action Venue	Minimum Standart Illuminance Level (lm/m ²)	Natural Lighting Values of Hasan Sezai Mosque	Artificial Lighting Values of Hasan Sezai Mosque
Praying/ Mihrab (For the imam)	300 lux	100 lux	100 lux
Praying/ Harim	100 lux	100-200 lux	108 lux
Speaking/ Minbar	300 lux	300 lux	600 lux
Praying/ Mahfil	300 lux	100-300 lux	120 lux
Management Association Room	300 lux	0.75-10-300-1000 lux	20-30-100-750 lux

In the simulation of first-floor natural illuminance values, it has been observed that the gallery void possesses an illuminance level ranging approximately between 100-200 lux, and this value is consistent with the mosque's illuminance values. Rooms within the prayer area that lack daylight openings to the exterior exhibit illuminance levels below the standards.

As a result of the artificial lighting simulation for Hasan Sezai Mosque, the existing luminaires' placement on the wall surfaces adjacent to window openings and in the upper ceiling zones between the ground and gallery floors has been observed to provide localized and dense illumination to the ground floor prayer area, resulting in an average illuminance of 100-200 lux. It is suggested that this level of illuminance suffices to meet the mosque's illuminance requirements. However, these simulations indicate that employing luminaires with diffusing characteristics instead of localized light sources for the lighting fixtures on the ground and gallery floors could be recommended to mitigate regional lighting spikes and create a more soothing ambiance within the religious space.



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The design of both natural and artificial lighting in religious structures constitutes a pivotal aspect that influences both the architectural and spiritual experience. A well-designed lighting scheme can emphasize the aesthetics of interior spaces, enhance the spiritual atmosphere, and elevate the worship experience. Proper analysis of the potential of natural lighting and careful selection of artificial lighting strategies hold critical significance in achieving successful lighting designs for religious buildings.

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**INVESTIGATION OF MONUMENTAL MOSQUES BELONGING TO THE
OTTOMAN PERIOD IN KONYA IN TERMS OF ENERGY EFFICIENCY**

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ABSTRACT

Konya has hosted many civilizations throughout its history and has been one of the important state centers of the Ottoman Empire. The city has many historical and cultural heritages. Monumental mosques are valuable elements of religious and cultural architectural heritage. In this respect, in this study, monumental mosques built in the Ottoman Period in Konya are handled. Mosques represent a central area where people gather for their daily and weekly prayers. They are used simultaneously in a specific region and time zone. This situation has an impact on the energy demand depending on the climatic regions during the heating and cooling periods of the building. In this respect, providing the comfort conditions in the interior space in an energy-efficient method is important and should be handled. This study, it is aimed to create and document the inventory of monumental mosques and to research the mosques in terms of energy efficiency. Architectural design properties and construction techniques of mosques are explained and energy analyses are made by using the DesignBuilder simulation program. The relationship between design properties and the energy demands of mosques is handled. It is aimed to show the importance of monumental religious buildings in terms of energy efficiency.

Keywords: Ottoman Architecture, Monumental Mosques, Energy Efficiency.

1. INTRODUCTION

Monumental mosques have great importance in terms of religious and cultural architectural heritage. Creating an inventory of these buildings is important for the protection of cultural heritage. Konya has been one of the most important main centers of Turkish-Islamic culture and art in Anatolia throughout its history. The city has preserved its importance for many years as the capital of the Anatolian Seljuk Civilization and as it is one of the important state centers of the Ottoman Empire. The city has many historical and cultural architectural heritages (Baykara, 2002). Mosques built during the Seljuk and Ottoman Periods provide the formation of the city morphology and create an important typology with their architectural design properties. In this respect, in this study, monumental mosques built in the Ottoman Period in Konya are handled.

Mosques represent a central area where people gather for daily and weekly prayers and are considered a place for the educational, cultural, and social activities of Muslims. They are characterized by their unique working hours. Mosques are used simultaneously in a certain region and time zone. They are used intermittently, five times a day and weekly. This situation



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has an impact on the energy demand of the building depending on the climate regions during the heating and cooling periods required (Al-Homoud et al., 2005). In addition, it is of great importance that the comfort of the user in a religious mosque building in terms of the sense of sacred worship. It should be possible to worship in a comfortable area for worshipers. In this respect, providing the comfort conditions in the interior space in an energy-efficient method is an important object and should be handled.

Climate-related design properties of buildings affect the comfort conditions and thermal performance of the building (Abdou et al., 2005). Mosque energy efficiency largely depends on the overall thermal performance of building components such as walls, roofs, and windows working together as a system (Al-Homoud et al., 2009). In a mosque with low thermal performance, more energy is consumed to provide comfort conditions. In the study of Al-Homoud et al., indoor comfort conditions were analyzed for three mosques located in the hot humid climate zone of Damman, Saudi Arabia. The relationship between these conditions and the consumed energy loads was evaluated. It was determined that only one of the mosques had a thermal insulation layer in the envelope. It was reported that two uninsulated mosques had higher levels of energy consumption and dissatisfaction in terms of thermal comfort. In conclusion, the importance of integrating a thermal insulation layer was emphasized (Al-Homoud et al., 2009).

In a study conducted to determine the factors affecting energy efficiency in mosques, contemporary literature on energy use in mosques was analyzed. As a result of the study, it was stated that the building envelope design and climatic factors are the most important factors in the energy use of mosques and that heating-cooling systems constitute a large amount of the energy consumed in mosques. At the same time, the study compared studies aiming to reduce energy consumption and studies aiming to increase energy efficiency. As a result, it has been stated that energy use can be reduced by optimizing the design and operational strategies of mosques (Azmi et al., 2021).

This paper, it is aimed to create and document the inventory of monumental mosques and to research the mosques in terms of energy efficiency. Studies in this area are limited. In this respect, this study is pioneering and will light on future studies. In this respect, it is aimed to contribute to the studies within the scope of energy efficiency and mosques, to investigate the current energy needs of buildings, which are important elements of the monumental architectural heritage built centuries ago, and to show the importance of mosques in terms of energy efficiency.

2. MATERIALS and METHODS

This study is prepared within the scope of the Scientific Research Project (BAP) and among the analyzed mosques and masjids, monumental mosque structures built in Konya during the Ottoman Period are handled. These are the Şerafeddin Mosque (17th century) and Kapu Mosque (19th century). First of all, using the analyzing technique in the literature, information about the mosques belonging to the Ottoman period, and Konya city are collected. The buildings are visualized with the drone and their features are documented with photographs. Drawings in the electronic environment are taken from the Konya Regional Directorate of Foundations and colored, and their current situation is based on on-site determinations and their relations with their immediate surroundings are processed on the drawings.



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The plan, section, facade, roof cover, and interior space elements are explained and design typologies are determined in the light of the information in the literature, drawings, and visuals. At the same time, the construction technique and material properties are explained. Mosques' architectural design features were documented and modeled in the Design Builder simulation program. Models specific to mosque structures that have characteristic features are developed in the DesignBuilder simulation program, taking into account the users, occupancy rate, and usage times. According to the simulation results, the heating-cooling and total energy loads of the mosques are analyzed. An evaluation is explained according to the findings.

3. FINDINGS and DISCUSSION

In this section, the architectural design properties of the Şerafeddin Mosque and Kapu Mosque built in the Ottoman Period and their energy loads according to simulation results are explained.

a. Ottoman Mosques' Architectural Design Properties

• **Şerafeddin Mosque, 17th Century**

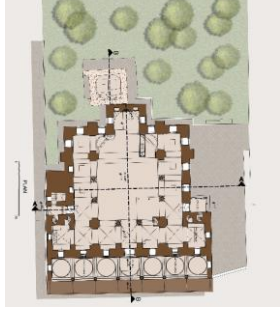
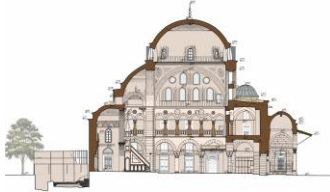

Şerafeddin Mosque is located in the east of Alaeddin Hill. The mosque was built according to the central domed plan scheme. The dome is supported by four large and six small pillars, and the dome is supported by a half-dome in the south. It is noteworthy that the building has been given height with the cover system. The covering system on the exterior is perceived by the main dome. It is remarkable that the building has been given height with the cover system. The covering system on the exterior is perceived by the main dome (Toktaş, 2016). Photographs belonging to the Şerafeddin Mosque are shown in Figure 1 and the architectural design properties of the Şerafeddin Mosque are shown in Table 1.



Figure 1. Şerafeddin Mosque (Photographs by the authors, 2019)

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Table 1. Şerafeddin Mosque's Architectural Design Properties

Design Typology			
	Period	17th Century, Ottoman Period	
	Building Form	Square	
	Top Cover	Dome	
	Plan Organization	Two Spaces	
	Building Order	Detached Order	
	Total Area of Mosque m²	714,47 m ²	
Construction Techniques and Material Properties			
	WALL	Bond Technique	Masonry Wall
		Material	Stone (Only three lines of bond of brickwork on the pointed arch surface of the southeast and northwest walls)
		Openings	Windows ratios are 1/2
	FLOORING	Material	Wood flooring
	TOP COVER	Bond Technique	Dome in masonry technique
		Material	Dome is brick
		Openings	There are openings
		Size (Diameter/Thickness)	Main dome: 1160x67, half dome: 325x57, last prayer hall: 329x35
MINARET	Bond Technique	Masonry	
	Material	Cut-stone	

• **Kapu Mosque, 19th Century**

Kapu Mosque is located in the city center of Konya. It was built in 1658 by Pir Hüseyin Çelebi. The first construction, which is thought to have a brick masonry bond dome, was destroyed for unknown reasons. It was rebuilt in 1811 by Abdurrahman Efendi. In the fire of Konya Bazaar in 1868, it was completely burned along with the stores around it. The mosque was rebuilt using stone materials by the grandson of Abdurrahman Efendi and with the help of the people of Konya. Kapu Mosque is the largest mosque built in Konya during the Ottoman period and has the characteristics of classical Ottoman mosque architecture. The mosque is made of stones mass on a square plan and the top is covered with eight domes of different diameters (Kapu Camii- KONYA, n.d.; Konyalı, 2007; Muşmal & Çetinaslan, 2009). Photographs belonging to the Kapu Mosque are shown in Figure 2 and the architectural design properties of the Kapu Mosque are shown in Table 2.

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Figure 2. Kapu Mosque (Photographs by the authors, 2019)

Table 2. Kapu Mosque's architectural design properties

Design Typology			
	Period	19th Century, Ottoman Period	
	Building Form	Rectangle	
	Top Cover	Hybrid Roof (Domed inside, pitched roof outside)	
	Plan Organization	Two Spaces	
	Building Order	Detached Order	
	Total Area of Mosque m²	1183.53 m ²	
Construction Techniques and Material Properties			
	WALL	Bond Technique	Masonry Wall
		Material	Stone
	FLOORING	Openings	Window ratios are square and 1/2
		Material	Prayer hall wood flooring, courtyard and entrance staircase stone covering
	TOP COVER	Bond Technique	Dome in masonry technique
		Material	Dome is brick
		Openings	There are no openings
		Size (Diameter/Thickness)	Hybrid Roof
	MINARET	Bond Technique	Masonry
		Material	The Minaret pedestal is stone, the truck is brick; the minaret balcony is brick

b. Energy Analysis of Ottoman Mosques

In this section, the Şerafeddin Mosque and Kapu Mosque belonging to the Ottoman Civilization, are analyzed in terms of energy efficiency in light of the literature review and simulation results. Mosques are modeled using the DesignBuilder simulation program. Design



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Builder is an EnergyPlus-based software tool developed to measure and analyze the performance of building design in terms of energy, carbon, lighting, and comfort (Zhang, 2014).

Konya is located in the temperate-dry climate region of Türkiye. In terms of energy efficiency, the period when heating is required in temperate-dry climate regions is important. Design parameters affecting the energy performance of a building are handled as the location and orientation of the building, the distance between buildings, the form of the building, the optical and thermophysical properties of the building envelope, and the solar control and natural ventilation layout. It can be said that energy-efficient design parameters are also valid for a mosque structure. However, mosques have characteristic design properties that affect the basic design such as qibla, qibla wall, mihrab, and minbar. In this respect, the orientation of mosque buildings is the direction of the qibla. The orientation of the Konya mosques (their qibla), which are handled within the scope of the study, is in the south direction.

Şerafeddin Mosque and Kapu Mosque have a detached order property. Passively benefiting from or being protected from the effects of sun and wind changes depending on the settlement texture and distance between buildings. This should be considered as a factor that is important in terms of solar radiation gain and natural ventilation and therefore affects the energy load of buildings. In this respect, building order should be handled as a factor affecting the energy load of mosque buildings. In terms of building form, the form of mosque buildings is square or rectangular, which should be in the temperate-dry climate zone. Other architectural design properties affecting the energy loads of Şerafeddin and Kapu Mosques and the heating-cooling and total energy loads of the mosques per m² are shown in Table 3 for comparative analysis.

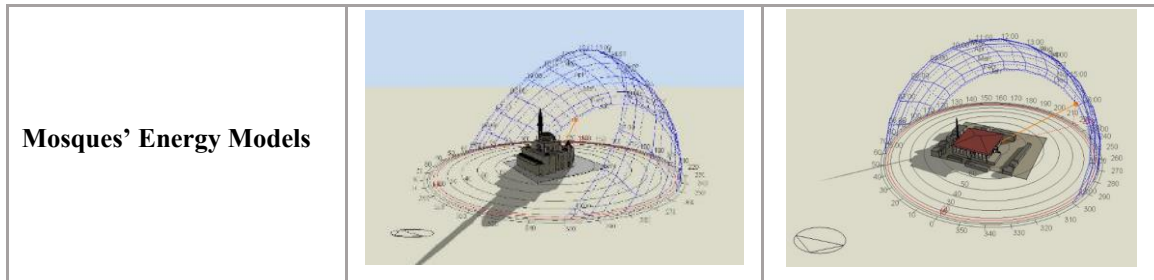
Table 3. Architectural properties and energy loads of Şerafeddin and Kapu Mosques

Mosque Name		Şerafeddin Mosque	Kapu Mosque
Total Area of Mosque m ²		714.47 m ²	1183.53 m ²
Mosque height (h)		24.14 m	16.60 m
Wall Material		Stone	Stone
Wall Thickness		150 cm	100 cm
Top Cover Material		Brick	Brick
Top Cover Thickness		67; 57; 35 cm	Hybrid Roof
Window-Wall Ratio (%)	South	7.27	9.87
	North	6.25	45.50
	East	6.81	9.87
	West	11.74	12.16
Cooling Load per m ² kWh		36.00	24.9
Heating Load per m ² kWh		215.52	176.83
Energy Consumed per m ² (heating-cooling-lighting) kWh		257.93	208.53



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In terms of the top cover, Şerafeddin Mosque has a dome and the Kapu Mosque has a hybrid roof. In this respect, it can be said that the top cover is one of the factors affecting the differences between the energy loads of the mosques. In terms of building materials, Şerafeddin Mosque's building materials are stone and the wall thickness is 150 cm. Kapu Mosque's building material is stone and the wall thickness is 100 cm. Stone building material has the qualification of contributing to the heating and cooling loads of buildings in terms of thermal performance. It should be noted that the thermal conductivity properties of the opaque and transparent components of the building envelope are important parameters that can affect the energy loads of the buildings. The thermal conductivity of the wall varies depending on the building material properties and wall thickness. Period differences between the Şerafeddin and Kapu Mosque, the type of stone material used, differences in wall thickness of mosques, and the type of glass used in the openings should be handled as factors affecting the thermal conductivity of the wall. It can be stated that the building materials used in the analyzed mosques have the qualification of reducing the energy load of the buildings. In this respect, mosques' envelope properties should be evaluated as the parameter that affects the energy needs of mosques.

The opening ratios of Şerafeddin and Kapu Mosques vary depending on the directions. Directional openings are important factors in terms of solar radiation gain and natural ventilation layout. It should be noted that openings in the south direction provide direct solar radiation gain, but multi-directional openings cause heat losses. In this respect, it can be said that the openings depending on the directions have an impact on the differences between the energy demand of the mosques. In addition, monumental mosque buildings' volume should be handled and evaluated as an important factor.

As a result, the parameters affecting the energy load of a mosque building make differences in mosques' energy loads, especially the envelope design, building material used, wall thickness, facade openings depending on directions, and size of the building. As a result, it can be said that more positive results are obtained in terms of energy efficiency for both mosques although the differences between the energy loads.

5. CONCLUSION and RECOMMENDATIONS

In this study, monumental mosques built during the Ottoman Period in the city of Konya, one of the most important main centers of Turkish-Islamic culture and art, are investigated in terms of energy efficiency. Şerafeddin Mosque and Kapu Mosque belonging to Ottoman Civilization are handled. The architectural design properties of monumental mosques have been documented. The energy consumption of the mosques is analyzed.

The amount of energy consumed per m^2 of Şerafeddin Mosque is 257.93 kWh, and the amount of energy consumed per m^2 of Kapu Mosque is 208.53 kWh. The energy demands of mosques vary depending on their architectural design properties. It should be noted that with these



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differences, positive results are obtained in terms of energy efficiency. It can be said that mosque buildings, which are important elements of the monumental architectural heritage built in the Ottoman period, are energy-efficient buildings in line with today's energy needs and traditional design features and construction techniques. In addition to energy analysis, building volume is an important factor in monumental mosque buildings in terms of energy efficiency. In this respect, it has been determined that the DesignBuilder simulation program, which calculates the energy load per m², is inadequate for mosques where volume is an important factor, and volume-related analysis results are required.

As a result, it can be said that monumental mosque structures are valuable and important structures in terms of energy efficiency in line with the energy loads consumed per m². Considering the limitations of studies on the energy demands and energy efficiency of monumental mosques, it is expected that this study will create potential research scopes for future research. In addition, documenting and protecting religious and cultural heritage and analyzing it in terms of energy efficiency has great importance in guiding mosques that will be designed as religious and cultural architectural elements with minimum energy requirements.

Information Note

This study is reproduced from the Mimar Sinan Fine Arts University Scientific Research Project (BAP) titled "Research of the Monumental Architectural Heritage in Terms of Comfort Parameters and Energy Efficiency, Seljuk-Ottoman Period" coordinated by Assoc. Prof. Dr. Ümit Arpacıoğlu.

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**COMPARATIVE ANALYSIS OF STEEL AND REINFORCED CONCRETE
STRUCTURAL FRAMES IN TERMS OF ENVIRONMENTAL IMPACT**

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ABSTRACT

The construction industry is responsible for a significant amount of energy demand globally. Building energy consumption and associated emissions have a great impact on the environment. In this respect, the construction industry has enormous potential to minimize its carbon footprint and the environmental performance of a building throughout its lifespan is an important issue. The environmental impact of buildings is measured LCA is an environmental management tool that holistically and systematically analyzes a product' or process' environmental impacts based on the energy and resources that they require throughout their lifespan. Structural elements are an important percentage of the total building material. The decision regarding a building's structural frame selection therefore has a major impact on the building's environmental impact. In this respect in this study, it is the purpose to explain and to compare steel and reinforced concrete framed buildings in terms of life cycle environmental impacts in the light of literature. It is aimed to emphasize the importance of structure selection in terms of solutions to environmental problems.

Keywords: Lifecycle, Environmental Impact, Steel and Reinforced Concrete Frames.

1. INTRODUCTION

Buildings account for a large amount of energy consumption and greenhouse gas emissions. Greenhouse gas emissions resulting from the use of fossil-based resources cause environmental damage such as global climate change, disruption of ecological balance, and destruction of natural resources. The depletion and destruction of these resources are also among the important problems. Building materials and components cause harmful effects on the environment with the natural resources they consume throughout their life cycles and the harmful emissions that occur at various stages of this cycle. The environmental impact is mainly related to resource consumption and emissions. In this respect, energy consumption is a widely used important measure of the buildings' environmental impacts (Fay & Treloar, 2003).

Assessment of the environmental impact of buildings or products throughout their lifespan is measured by Life Cycle Assessment (LCA). LCA is an environmental management method that systematically and holistically evaluates the environmental impacts of a product or process. Evaluated variants include resource use as well as various emissions to soil, water, and air. The emissions mostly caused by a building product are CO₂, CH₄, SO₂ (sulfur dioxide), Nox (Nitric



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Oxide), and C_2H_6 (ethane). CO_2 causes global warming, SO_2 and NO_x cause acidification, and ethane and methane cause photochemical oxide formation (Aydın & Sancak, 2005). Important climate changes are significantly related with increasing atmospheric concentrations of certain gases, especially carbon gas. Most of the carbon dioxide emissions that cause the greenhouse effect occur due to the use of fossil fuels for energy production and consumption (Çoban & Kılınç, 2015).

Structural elements constitute the largest percentage of the total building materials and have a greater environmental impact than most other building elements, such as cladding, flooring, and roofing (Stek et al., 2011). Therefore, the structural framework decision of a building has a major effect on the environmental impact of the building. In this respect, this study aims to emphasize the importance of structural frame selection in terms of solutions to environmental problems. The reinforced concrete frame is handled in terms of Türkiye's building stock, and the steel frame, which is a recyclable and widely used material and which has a significant impact in terms of load-bearing, is handled.

2. MATERIALS and METHODS

In the study, firstly, using the analyzing technique in the literature, environmental impact and life cycle assessment (LCA) are systematically explained. The steel and reinforced concrete structural frames are explained within the scope of life cycle assessment in terms of energy consumption and related environmental emissions. Studies in the field of comparative analysis of steel and reinforced concrete framed structures are analyzed. In this direction, an evaluation is made.

Steel and Reinforced Concrete Frames in Scope of Life Cycle Assessment (LCA)

Buildings cause a great burden on the environment due to the consumption of large amounts of energy, and greenhouse gas emissions resulting from the building materials production and the operation of the building system (Xing et al., 2008). In recent years, to measure the effects of important environmental impact factors and effectively recommend improvement precautions, LCA-based building environmental impact assessment models have been developed (Su et al., 2017). A building is analyzed throughout its lifespan with the Life Cycle Assessment method in terms of resource use and environmental emissions. As an important tool of environmental management, LCA is an internationally accepted method.

Life Cycle Assessment can be defined as analyzing and evaluating the inputs, outputs and potential environmental impacts of a product or system throughout its life cycle (Zuo et al., 2017). The LCA method analyzes different possibilities and scenarios to minimize resource and energy consumption and reduce the environmental footprint of building materials (Oladazimi et al., 2020). LCA analysis methods are basically handled in four different ways in the literature: process analysis, process-based hybrid analysis, input-output analysis, and input-output hybrid analysis. A building consumes energy in the form of operational and embodied energy over its lifespan. Operational energy is the energy required to provide comfort conditions interiors of buildings. It is a sum of energy used for heating-cooling, ventilation, lighting, hot water supply, and equipments (Cabeza et al., 2014). Embodied energy is the energy required for the production of building materials, construction, maintenance and repair, and all activities at the demolition stage over the life cycle. Studies highlight the importance of both operational and embodied energy of buildings throughout their lifespan (Fay & Treloar, 2003). In this respect,

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building design and structure selection are of great importance for the studies in the scope of reducing greenhouse gas emissions at the national level. The life cycle stages of a building and its relations are shown in Figure 1.

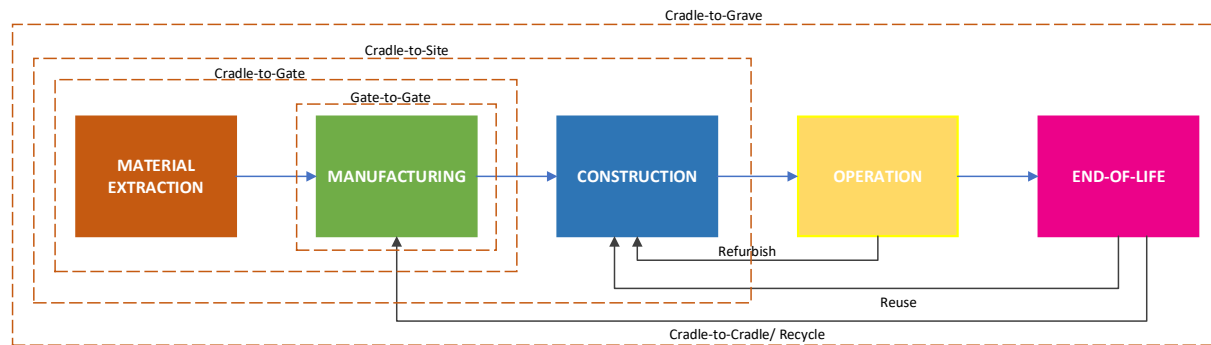


Figure 1. Life Cycle Stages of a Building (Simonen, 2007)

In terms of structural frames, steel and reinforced concrete building materials have embodied energy and greenhouse gas emissions such as carbon in the stages of their life cycle. Embodied energy is in the formation of the building material. It largely depends on the type of material used, primary energy sources, and the conversion efficiency of building material production processes (Koç et al., 2022). The embodied energy of a building is basically the energy used during the production of building materials and components and during the construction, maintenance/repair and demolition of the building.

Embodied energy is the sum of embodied energies of initial, recurrent, and demolition. Initial embodied energy indicates to the total energy used to extraction of raw materials, products and components produce and transport, and construct a building. Recurrent embodied energy is the energy demand to maintain or repair the building while it is in the use stage. Recurrent embodied energy depends on how the building is used by users, users' maintenance demands, the service life of the building, and the lifespan and materials and components quality. Finally, demolition energy indicates the total energy consumption to destroy the building, recycling and reusing some components, transporting waste to landfills, and disposing of others at the end of its life cycle (Azari & Abbasabadi, 2018). Life cycle stages and their scopes as factors affecting embodied energy and carbon loads throughout the life cycle of structural frames are shown in Figure 2.

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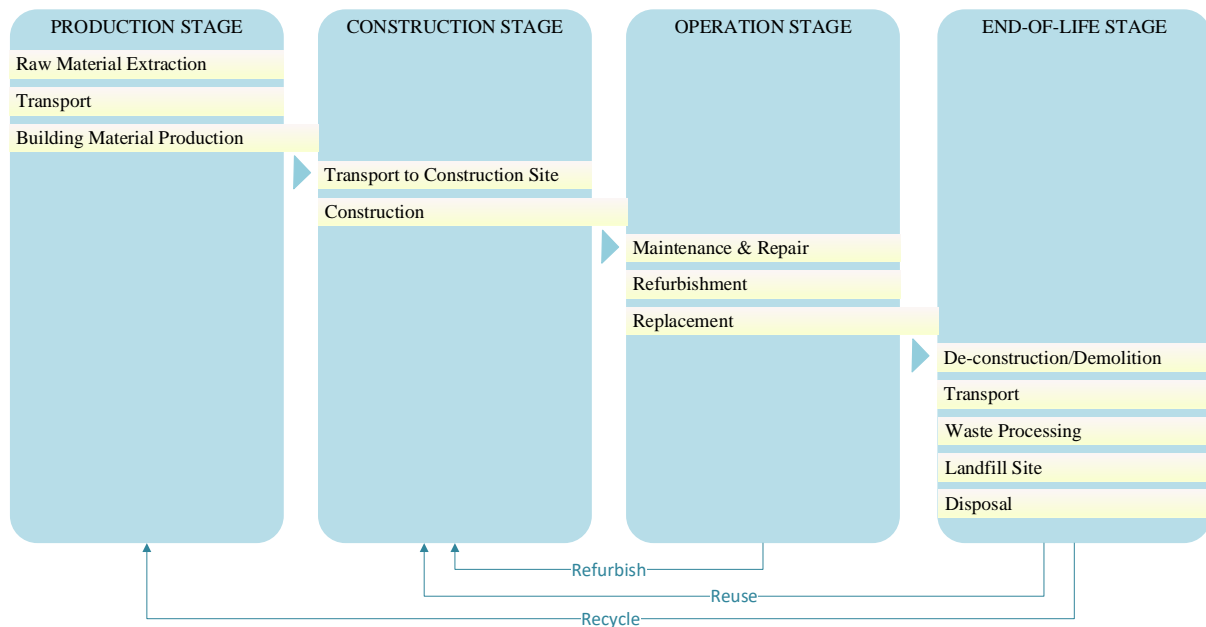


Figure 2. Life cycle stages and scopes in terms of structure

Steel is an alloy obtained from iron. Structural steel used in load-bearing systems is formed by adding 0.2-1% carbon and other additive materials to iron ore. Rivets, bolts, or welding methods are used as connection elements in the steel structure system. After the iron is extracted, melting, rolling and casting forming methods can be used in the manufacturing phase. Cold-formed galvanized sheet profiles are used in light steel load-bearing systems. Steel building material is accepted 90% recyclable or reusable during the demolition phase (Eren & Başarır, 2013). At the same time, waste can be used as a byproduct or energy.

The reinforced concrete structure consists of concrete and steel reinforcing bars. Concrete consists of approximately 60-80% aggregate, 10% cement, and 15% water. By-products used in concrete are fly ash and blast furnace slag. The environmental impacts of the energy and emissions used in concrete manufacturing are largely due to cement. The rate resulting from aggregate is approximately 3%. Evaluating the environmental impacts of concrete and concrete products depends on the material and energy flows that occur throughout their life cycle. Factors causing these effects: the use of fossil fuels, the use of natural raw materials, the use of land, and the use of energy (Aydın & Sancak, 2005).

Studies in the Scope of Life Cycle Assessment of Steel and Reinforced Concrete Structural Frames

In this section, studies in the scope of comparative analysis of steel and reinforced concrete framed structures in terms of environmental impact are explained. In Xing et al.'s study (Xing ve diğ., 2008) the environmental impacts of two different office buildings in China, steel and concrete frame, are compared. In this direction, a life cycle inventory model has been developed for office buildings. The aim of the study is to identify and to measure the energy consumption and environmental emissions of two typical office buildings throughout all life cycle stages. Environmental impact categories are handled as energy consumption, greenhouse gases and main pollution emissions (general emissions and urban emissions). In this study, BESLCI program developed by Huang is used as the LCA software tool. The lifespan of the buildings is



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50 years. As a result, it is seen that the steel-framed building has better performance than the concrete-framed building in terms of life cycle energy consumption and environmental emissions. However, during the usage stage, the energy consumption and emissions of the steel-framed building are higher than the concrete-framed building. The study states that the energy consumption of the steel-framed building during its use stage will be reduced if thermal conservation can be improved.

In Kim et al.'s study (Kim et al., 2013) the environmental impact of steel and reinforced concrete structural frames is analyzed. In the research conducted on steel and reinforced concrete framed four buildings (two high-rise and two low-rise buildings), the amount of CO₂ emissions and energy consumed are estimated using input-output analysis. Four office buildings are located in Seoul. Analyzed input materials include cement, sand, gravel, formed steel, steel sheet, and steel plate. The results show that reinforced concrete building frames have 26% less CO₂ emissions and 29% less energy consumption than steel frames. It has been stated that most of the emissions originate from the steel production process. The study also analyzes construction and carbon emission costs, and as a result, it is found that the total cost of the reinforced concrete framed building is approximately 9.8% lower than the steel framed building. In this study, the difficulty of comparing studies in detail has been noted due to the scope of this study is limited to the input materials used in different structural frames, and the lack of definition of what is included in total energy estimates.

In Oladazimi et al.'s study (Oladazimi et al., 2020) the comparative life cycle of steel and concrete structural frames is handled and two multi-story residential buildings in Iran are investigated. A six-story reinforced concrete building and a seven-story steel building are analyzed. GaBi LCA Software (Version 8.7) is used in the study. The lifespan of the structures/buildings is handled as 50 years. All stages of the life cycle are analyzed. The construction stage data are obtained from the designers and contractors of the buildings. The necessary data for raw material extraction, material production and end-of-life stages are obtained from international and regional sources. Since the research focused on comparing the structural frames, other elements such as walls and floors are accepted to be similar. In this study, while the steel building structure is considered 100% recyclable after demolition, the steel reinforcing bar used in the concrete building is considered 85% recyclable and all concrete waste is landfilled. Environmental impacts are handled as global warming potential, eutrophication potential, resource depletion (water and mineral), acidification, human toxicity, fossil fuel consumption, climate change, air acidification and biotoxicity. As a result, the total pollution of the concrete frame is higher than that of the steel frame in all the specified impact factors. A concrete building created more waste/pollutants, therefore this results in a higher environmental impact. Steel building has a more harmful impact on the ecosystem than concrete building in only one category, resource consumption (fossil and renewable resources, minerals). Additionally, the two stages extraction of raw material and end-of-life generated more pollution than any other life cycle stage. In addition, the biggest contribution in terms of non-organic emissions is CO₂ and the biggest contribution among organic emissions is methane. Findings show that choosing a steel frame is more environmentally friendly than a concrete frame.

In Balasbaneh & Ramli's study (Balasbaneh & Ramli, 2020) a comparative life cycle assessment of concrete and steel prefabricated buildings in Malaysia is handled. The buildings are evaluated according to five environmental impact categories using SimaPro 8 software. These impact categories are greenhouse gas emissions, respiratory inorganics, non-renewable



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energy, mineral/raw material extraction, and land use. According to the findings, the emissions of steel structures are higher than concrete structures only in the greenhouse gas category, while the emissions of concrete structures are higher in other environmental categories. Electricity use for equipment is found to be greater for steel than for concrete in all categories. Material wastage for concrete is higher than for steel in all categories. Recycling and reuse can reduce total emissions from steel frames. Using steel can minimize waste and therefore contribute to reducing environmental impact. The study also analyzes these two buildings in terms of life cycle cost-efficiency. As a result, although the cost of the construction stage of the steel prefabricated building is higher, the overall cost of the concrete prefabricated building is higher in terms of life cycle cost.

3.FINDINGS and DISCUSSION

The main properties and outcomes of the studies examined within the scope of the study are shown in Table 1.

Table 1. Studies on the environmental impact of steel and reinforced concrete frames

References	Year	Environmental Impact Categories	LCA Phases	Main Results
Xing et al.	2008	Energy use, greenhouse gas emissions, basic pollution emission	All LCA phases	The steel-framed building has better performance than concrete-framed building. However, during the operation stage, the energy consumption and emissions of the steel-framed building are higher than the concrete-framed building.
Kim et al.	2013	Energy use and CO2 emission	Manufacturing phase	Reinforced concrete building frames have 26% less CO2 emissions and 29% less energy use than steel frames.
Oladazimi et al.	2020	Global warming potential, eutrophication potential, resource depletion, acidification, human toxicity, fossil fuel consumption, climate change, air acidification and biotoxicity	All LCA phases	The total pollution of the concrete frame is much higher than that of the steel frame in all the mentioned impact factors except one. Steel building has a harmful impact than concrete building on the ecosystem in only one category, resource consumption (fossil and renewable resources, minerals).
Balasbanih & Ramli	2020	Greenhouse gas emissions, respiratory inorganics, non-renewable energy, mineral/raw material extraction, and land use	All LCA phases	The emissions of steel structures are higher than concrete structures only in the greenhouse gas category. In other environmental categories, emissions of concrete structures are higher.

When comparative analyses of steel and reinforced concrete structural frames are handled, there are studies in which both building materials have high or low performance in terms of environmental performance. In the light of the literature and in line with the analyzed studies, the reasons for the different results of the studies can be handled as focusing on different stages



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of the life cycle, differences in the methods and boundaries of the study, and environmental and structural properties. Ideally, all life cycle stages should be investigated to understand and evaluate the total environmental impacts of a structure. If all stages are not analyzed, information about which stage and why the effects occur can not be fully evaluated.

The steel-framed building has many obvious advantages compared to the reinforced concrete-framed building. For example, a steel-framed building is more convenient for protecting the environment because it produces less solid waste and can be recycled at the end of its life. The steel frame can also provide material efficiency. For example, structural steel elements can bear more load than other materials with smaller cross sections. In Eren & Başarır 's study (Eren & Başarır, 2013) is stated that the equivalent of a column of 100x100 cm in a reinforced concrete structure is 40x40 cm in a steel structure. This will increase material efficiency. However, it is not appropriate to state which type of structural frame is qualitatively and quantitatively energy efficient and environmentally friendly. Ideally, all stages of the life cycle and stages' relationships with each other should be analyzed to select a structural frame that has high environmental performance.

In terms of steel and reinforced concrete structures, different cost efficiencies can be observed at different stages of the life cycle. Life cycle cost, as with energy and emissions, should be investigated throughout the entire life of the structural frames. The cost of a building should be handled in line with parameters such as construction time, labour cost, maintenance/repair cost, and cost in terms of building material usage. Especially for the structural frame selection for an effective application area, the environmental argument must be supported in terms of cost.

4.CONCLUSION and RECOMMENDATIONS

In this study, steel and reinforced concrete frames are systematically explained within the scope of environmental impact and life cycle assessment. The studies in environmental impact context are investigated. In this direction, it is emphasized the necessity of studies on the evaluation of the energy efficiency and environmental protection performance of different building designs and structural frame selection based on the whole life cycle. The environmental impacts of a building's whole lifespan must be known and analyzed to build an environmentally friendly building. Life cycle assessment (LCA), which analyses and evaluates the impacts of all life cycle stages, is the best and most important method to achieve this goal. Building design and structure selection is an object that needs to be handled within the scope of environmental impact in order to solve problems such as global climate change and resource depletion. It is necessary to construct buildings that have high environmental performance by handling parameters such as the energy of building materials, reducing construction waste, reusing products, and using highly recycled materials.

Energy and environmental emissions are important parameters that need to be optimized due to their national and global importance. In the context of structural frame selection, more detailed quantitative studies are required to conclusively determine the impacts on energy and the environment. To select a structural frame that has high environmental performance, all stages of the life cycle and their relationships with each other should be analyzed. In a process where urban transformation is on the agenda, steel structures should be also handled together with reinforced concrete in order to construct buildings and frames that have high environmental performance and a decision must be made as a result of comprehensive environmental analysis.



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THE EFFECT OF THE ENVIRONMENT ON THE EVALUATION OF TALL BUILDING FORMS

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ABSTRACT

The study examines the impact of the environment on the perception and appreciation of tall buildings. It also questions how perception and appreciation change when the quality of the environment changes. The working hypothesis is that the environment and the quality of the environment will be effective in the perception and appreciation of a building. In line with this objective; eight (8) tall building forms were determined with reference to the studies in the literature and these forms were modeled through the Sketchup program. Then the plots where the forms will be installed were determined. Ulus, consisting of low-rise historical buildings that form the backbone of the city of Ankara, and Kavaklıdere, consisting of high-rise modern buildings, were taken as reference. These lands were also modeled through the Sketchup program. After both building models and environmental models were produced, the images were mounted together using Photoshop. In this way, a total of 24 images were obtained: eight (8) single buildings, eight (8) buildings mounted in historical environments and eight (8) buildings mounted in modern environments. These images were shown to the final year students of Gazi University Department of Architecture and they were asked to evaluate the images within the scope of the variables of liking, impression and complexity. As a result, it was found that the environment has an effect on the perception and appreciation of a tall building. The environment decreases the impressiveness of the forms, increases their complexity and decreases their appreciation. Tall buildings are appreciated more and found more impressive in a modern environment.

Keywords: Tall Buildings, Environment, Impressiveness, Liking, Complexity, Perception.

1. INTRODUCTION

1.1. What is a Tall Building?

There is no universal definition of tall buildings in the literature. The definitions and height limits of tall buildings vary according to the structure of the buildings, construction systems, fire and earthquake regulations, building standards, professions and specialties (Ali & Armstrong, 1995; Yıldız, 2023). When various guidelines on tall buildings are examined, it is seen that definitions are shaped depending on many criteria such as land and road widths, urban silhouette, surrounding structures and visual impact. The height limits of buildings also vary considerably from one city to another. Table 1 shows the height limits and definitions of various cities. Accordingly, a 4-story building in a historic city is considered a high-rise building, while a 4-story building in a modern city is considered a low-rise one. In cities such as Chicago and



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Los Angeles, where high-rise buildings were first developed, the minimum height limit is 20 stories. In cities such as London, where high-rise buildings develop in a more controlled manner, relative height is determined instead of setting any height limit. In other words, height limits are determined according to sub-regions determined as a result of urban analysis, rather than covering the entire city. When the building definitions in the table are evaluated, the fact that the building is significantly higher than the surrounding buildings and that it can be distinguished in the urban silhouette are effective in defining it as a tall building. In addition, in some cities, land and road widths are also influential in determining building heights and forms. All these definitions emerge as a result of the specific relationships that tall buildings establish with cities. In each city, developments are shaped depending on urban data.

Table 1. Definitions of tall buildings and height limits in various guidelines

City	Definition	Height	City	Definition	Height
Bristol	Structures that are significantly taller than their surroundings and/or change the city skyline	>9 floor	Merton	Buildings whose height is greater than the road width of the neighboring street or the wider of two intersecting streets	Relative height
Burlington	When carefully designed and positioned, they are unique elements of the city character and skyline.	>11 floor	Nelson Mandela	A building that is 50% or more higher than the surrounding buildings within an area of 100 meters in diameter	>8 floor
Cambridge	Any building that stands out from the existing city skyline and is taller than the surrounding buildings	>6 floor	New Castle	A building that stands out from the city skyline and/or is significantly higher than the surrounding buildings	-
Cardiff	Buildings that have the potential to create significant value in the city	>8 floor	Northampton	A building that stands out from the city's skyline and/or is significantly higher than the surrounding building stock	-
Hackney	Buildings or structures that are significantly taller than their surroundings	>10 floor	Pickering	The building consists of a podium with active areas and a lobby on the ground floor and a tower with living areas, condominiums and office spaces on the upper floors	>13 floor
Los Angeles	-	>20 floor	Ottawa	-	>10 floor
Hamilton	Buildings that are taller than the width of the neighboring street and exhibit slenderness depending on the context they are associated with	>12 floor	Toronto	Buildings whose height is greater than the road width of the neighboring street or the wider of two intersecting streets	>12 floor
London	Buildings that dominate the local and city silhouette with their presence and impact as they increase in height	Relative height	Worting	Structures that are significantly taller than their surroundings and/or change the city skyline	>7 floor

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When the definitions and height limits of tall buildings in our country are examined in the light of these definitions; it is understood that the definitions are shaped according to the limited data determined by the standards and regulations. In the Istanbul Zoning Regulation (2007), a tall building is defined as "a type of building that generally affects its immediate and distant surroundings in terms of physical environment, silhouette, urban texture and all kinds of urban infrastructure. It is defined as "buildings with a building height of at least 60.50 meters at the lowest level visible from any facade of the building". In the Planned Areas Zoning Regulation (2018), high-rise buildings are defined as 'buildings with a building height of more than 21.50 meters or a structure height of more than 30.50 meters are high-rise buildings. Buildings with a building height of more than 52.50 meters or a structure height of more than 60.50 meters are very high buildings'. In the New Turkey Building Earthquake Regulation (2018), buildings with building height class 1 are considered as high-rise buildings, while the height limits according to the earthquake design class are determined as $H > 70$ meters for 1st and 2nd class, $H > 91$ meters for 3rd class and $H > 105$ meters for 4th class (AFAD, 2018). Therefore, although the height limits in the regulations have been increased over time, the relationships of the buildings with the urban environment are ignored in the definition of tall buildings. As a result, when evaluated in the light of guidelines and regulations, tall buildings are complex structures that are very difficult to define. According to urban data, height limits and height perception vary considerably. In order to eliminate this complexity, the Tall Buildings Council (CTBUH) has developed three (3) criteria for defining tall buildings; contextual conditions, building proportion and technological advancement of the building (Figure 1). A building is considered tall if it meets one or more of these criteria.

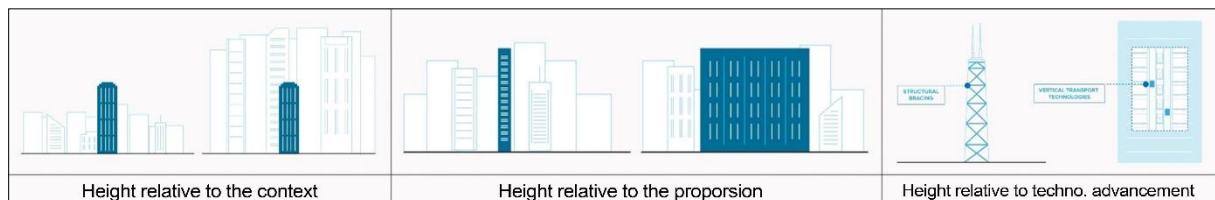


Figure 1. Height criteria according to the Tall Building Council (CTBUH, 2023)

In this study, based on the definitions in the guidelines and the CTBUH's proposal, tall buildings are defined as buildings that are significantly higher than the surrounding buildings, distinguishable in the urban skyline, slender in terms of building proportion and technologically innovative.

1.1. Tall Building Forms

Tall buildings can be classified in various ways in terms of form. While orthogonal forms such as squares, rectangles and circles were common in the 19th century, when tall building construction first emerged, today quite complex forms can be produced thanks to the possibilities of technology and construction systems. Therefore, due to the difficulty of classifying tall buildings in terms of form, classifications have been developed according to various parameters. Inspiration from computer commands (Vollers, 2008); shaping according to structural and energy efficiency principles (Taghizadeh & Seyedinnoor, 2013) and shaping according to aerodynamic effects (Kim & You, 2002; Irwin, 2009; Amin & Ahuja, 2010; Amin & Ahuja, 2010; Tanaka et al., 2013; Ilgin & Günel, 2021) are the parameters according to which tall building forms are frequently classified. Especially aerodynamic loads are very effective in

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determining the form as they are one of the most exposed loads as the height of the building increases. In this study, eight (8) basic form categories were determined for tall buildings with reference to the studies in the literature; simple form, circular form, hyperbol form, tapering form, layered form, opening form, conoid and twisted form (Figure 2).

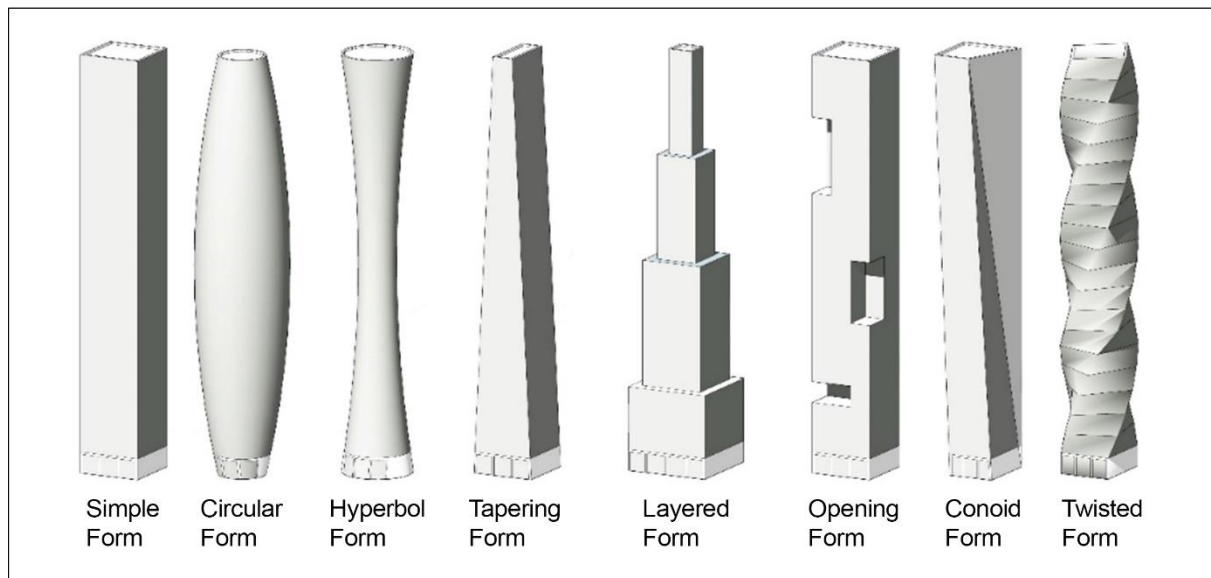


Figure 2. Tall building forms

1.3. What is the Environment and the Impact of the Environment on Tall Buildings

Environment, in the most general sense, is the physical, biological, social, economic and cultural environment in which humans and other living things maintain their relations and interact with each other (Berkes & Kışlalıoğlu, 1990). The urban environment is the environment where people's interactions are shaped with all its physical components such as streets, squares, avenues, houses, sculptures, parks and architecture. Urban environments create a whole and unique character with their natural factors such as topography, climate, vegetation and geological structure (Ocakçı, 1995). Historical environments are places that reflect the social, cultural and economic structure, philosophy of life and aesthetic concerns of past civilizations. They are places where culture and historical accumulation are revealed, and which illuminate the past by bringing the architectural styles, technological developments, interactions, experiences and cultural achievements of past periods to the present day (Arabacıoğlu & Aydemir, 2007).

The urban environment and especially the historic environment have many effects on tall buildings. In fact, this is a mutual interaction and the effects of tall buildings on the environment are generally questioned. In this study, unlike generalizations, how the environment affects tall buildings is investigated. First, the environment plays a direct role in the perception of the building. A tall building must compromise with the existing urban environment. The scale of the building must solve the problem of the image of the city, its relationship with the surrounding structures, and mass (Beedle et al., 2007). The character of the surrounding structures and open spaces is important in whether the building is perceived as high, low, dominant, naive, or overwhelming. In an environment consisting of low-rise historical



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buildings, a high-rise building is perceived as more dominant and overwhelming as it separates from its surroundings, while in an area surrounded by multi-storey buildings, the building becomes more noticeable as it separates from its surroundings. Features such as the location of the building, material selection and form are also very effective in the perception of the building. Location and site selection can enable the building to be adopted as a reference point within the area. When the material selection of the building is in harmony with the environment, it creates a value within the area, while the use of incompatible materials can destroy the effect of the building. The environment creates a framework for defining a building and determining its boundaries. In addition, a sense of closure is necessary in defining streets and avenues (Özer, 1992).

Environment is effective in determining the form of tall buildings. High-rise buildings are generally shaped in a tripartite configuration called base-middle-top (Sev, 2009). The environment is effective in shaping this form. The base part of the building is usually the part related to the street. By keeping this part wider than the upper parts, the building is prevented from creating a dominant effect on the environment. Single masses, on the other hand, have a more dominant effect on the environment and negatively affect the human scale. However, single masses are the most appropriate form of construction for buildings on narrow parcels. Therefore, parcel and land conditions are also effective in determining the mass and form of the building. Topographical features of the environment, vegetation, underground and surface water resources, transportation and infrastructure systems are other factors that influence the shaping of tall buildings.

When the studies on the effect of the environment on the perception and appreciation of buildings are examined in the literature, the effect of geology, topography, and local environmental character on the design of buildings is questioned through the complexity variable in Bovill's study in 1996. In Heath, Smith & Lim's (1993) study, tall building facades were evaluated according to complexity and silhouette variables. The impact of the environment was not questioned in this study. In Imamoğlu's (2000) study, traditional and modern residential facades were evaluated through the variables of liking, complexity, and familiarity. It was found that there was an inverted 'U' relationship between complexity and liking. In other words, a moderately complex image was preferred more than very complex and less complex ones. In Stamps' (2002) study, the relationship between the silhouette line of the built environment and the silhouette line of the mountains and hills was questioned. In Akalın et al.'s 2008 study, detached house facades were analyzed in terms of complexity, desirability, and impressiveness. In Erdoğan et al.'s study (2013), residential facades of different styles were analyzed in terms of familiarity, impressiveness, complexity and liking variables. Ostwald and Vaughan (2016) measured the visual diversity and complexity of different forms of representation (from simple to complex) on building facades. Lionar & Ediz (2020) examined the impact of urban background on the design of buildings. As a result, there are few studies in the literature that investigate the impact of the environment on

the perception and appreciation of buildings, and these studies generally examine residential facades. There is no study that evaluates the effects of the environment on tall buildings. The contribution and differentiation of this study to the literature is to classify high-rise buildings in a typology from simple to complex and to question the impact of the environment on perception and taste. The study evaluates two contrasting types of environments and questions how the quality of the environment affects perception and taste.

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In the study evaluated on the form variable, tall building models were developed according to eight building forms obtained from the literature. These models were evaluated in terms of complexity, liking and impression by means of a questionnaire study, both individually and assembled in two different environments. The results show whether the environment influences the perception and appreciation of a building.

2. MATERIALS and METHODS

The study methodology is based on a questionnaire survey. According to the data obtained from literature studies, eight (8) building forms were determined; simple, circular, hyperbol, tapered, layered, opening, conoid and twisted forms (Figure 2). Each form was modeled with the Sketchup 2021 program. The building models have the same height (200 m), floor area (30-30 m), ground floor arrangement and roof area, but differ only in form. Then, the backgrounds (environment models) on which these models will be mounted are designed. In the study where both environment models were designed with the Sketchup program, their opposite qualities were decisive in the development of the environments. While one of the environments consists of historical, low-rise, ornamented, and detailed buildings; the other one consists of multi-storey, modern, simple and plain forms buildings. For this purpose, the buildings in Ulus and Kavaklıdere, two sub-regions on Atatürk Boulevard, which form the backbone of the city of Ankara, were used as reference. Two undeveloped plots of land were identified in both areas. High-rise building models were developed to be positioned on these lands. For the Ulus area, the land at the intersection of Atatürk Boulevard, Cumhuriyet Street and Anafartalar Street, which is currently planned to be demolished, was selected. In Kavaklıdere area, an empty land between the General Directorate of Foundations and Celal Bayar Business Center on Atatürk Boulevard was selected. Topography, roads and buildings that shape the character of both areas were modeled.

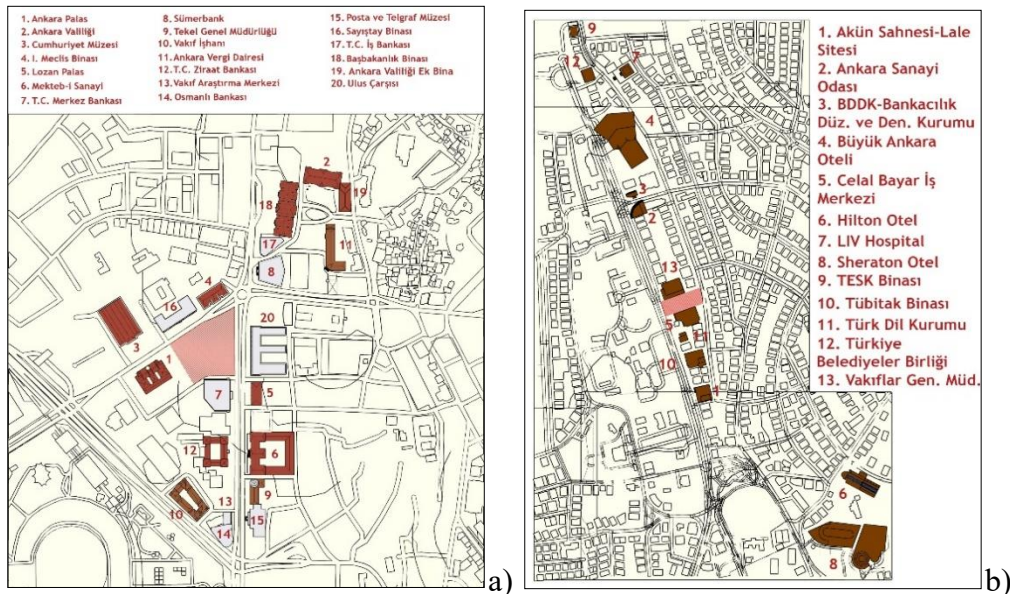


Figure 3. a) Ulus region b) Kavaklıdere region

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After both building models and environmental models were developed, the images were mounted together using Photoshop software. In this way, a total of 24 images were obtained: eight (8) single buildings, eight (8) buildings mounted in the historic environment and eight (8) buildings mounted in the modern environment. In the study, the perspective of the images is arranged according to the urban perspective. Since only the ground floors of tall buildings can be perceived from the street, it was deemed appropriate to limit the study to an urban perspective.

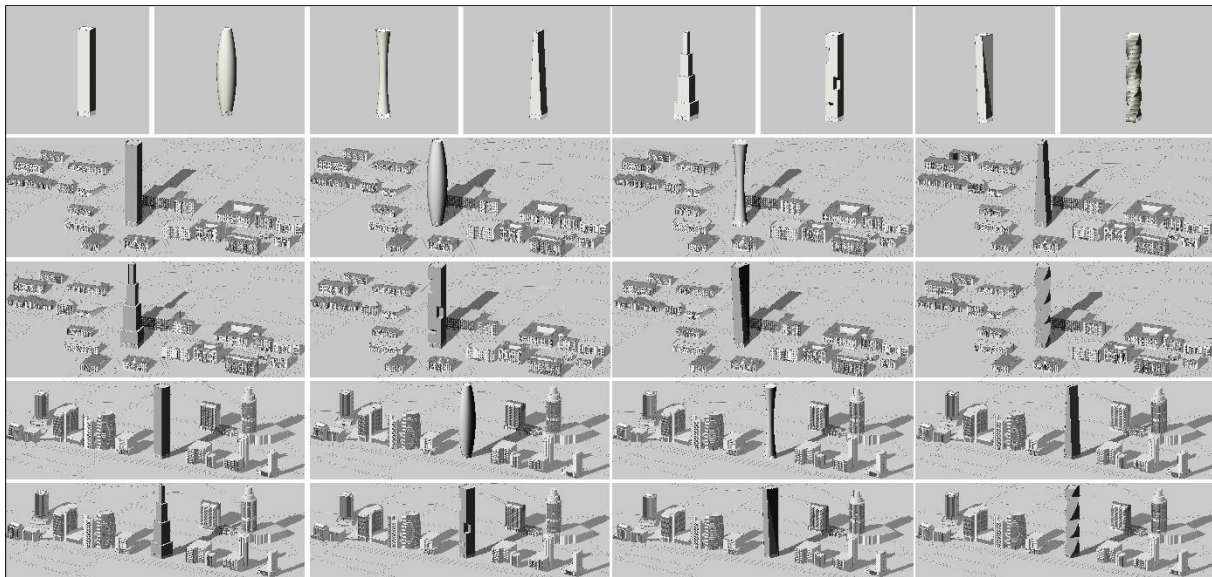


Figure 4. Images used in the study

The survey was conducted with a total of 52 fourth year (4) students of Gazi University Department of Architecture. Since the study was conducted with a homogeneous group, the number of samples was kept limited. The images were shown to the students in the classroom environment by projecting them on the screen. The images are presented in random order. Each image was shown on the screen for 15 seconds and the students were asked to evaluate these images according to the variables of liking, impression and complexity. The survey was completed in a total of 6 minutes. The data obtained were analyzed with statistical methods in the SPSS program. The relationship between the variables was evaluated by correlation analysis and semantic differences were evaluated by Anova test.

3. FINDINGS and DISCUSSION

The reliability analysis of the dependent variables in the study was analyzed according to Cronbach's Alpha. The Cronbach's Alpha value of the impression variable is 0.96; the complexity variable is 0.89; and the liking variable is 0.9. Generally, a value above 0.7 is considered as an acceptable reliability value. Therefore, the dependent variables have statistically high reliability values. The study was conducted with a total of 52 participants. 65% of the participants were female students and 35% were male students. Before showing on to the visual questions, the participants were asked to indicate how effective the urban environment is in the perception and appreciation of a tall building. Participants were asked to rate their evaluations on a scale of 1: very unimportant to 5: very important. In response to this question, 56% of the participants stated that the environment was very important in the perception and



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appreciation of the building and 36% stated that it was important. In other words, with a rate of 92% in total, the participants evaluated the environment as an important criterion in the appreciation of the building.

The proportional relationship between the participants' responses to the dependent variables (liking, complexity and affect) and the environment and form variables was analyzed. In the correlation evaluation, the correlation coefficient takes a value between 1 and -1. A value of 1 indicates a strong positive correlation, 0 indicates no correlation, and -1 indicates a strong negative correlation. Accordingly, there is a statistically significant relationship between impression and regions ($p < 0.05$). There is a significant relationship between impression and circular form (0.2 units), hyperbol form (0.22), tapering form (0.35), layered form (0.36), opening form (0.67), conoid form (0.39), and twisted form (0.69). There is a statistically insignificant relationship between complexity and regions ($p > 0.05$). There is a significant relationship between complexity and circular form (0.44), hyperbol form (0.31), tapering form (0.18), layered form (0.70), opening form (0.82) and conoid form (0.59). There is a statistically significant relationship between liking and regions ($p < 0.05$). There is a significant relationship between liking and circular form (-0.21), hyperbol form (0.24), tapering form (0.16), opening form (0.11), conoid form (-0.07) and twisted form (-0.19).

Table 2. The relationship between dependent variables and independent variables

Variables	Impression		Complexity		Liking	
	Estimated Std.	Pr(> t)	Estimated Std.	Pr(> t)	Estimated Std.	Pr(> t)
Region 2	0.20	9.92e-06***	-0.00	0.81417	0.14	1.37e-05***
Form 2	0.20	0.028797*	0.44	1.42e-10***	-0.21	0.000983***
Form 3	0.22	0.017539*	0.31	7.12e-06***	-0.24	0.000304***
Form 4	0.35	0.000162***	0.18	0.00851**	0.16	0.016717*
Form 5	0.36	8.10e-05***	0.70	<2e-16***	0.00	0.950279
Form 6	0.67	2.84e-13***	0.82	<2e-16***	0.11	0.091521
Form 7	0.39	2.52e-05***	0.59	<2e-16***	-0.07	0.320361
Form 8	0.69	1.34e-13***	1.13	<2e-16***	-0.19	0.003565**

Signif. Codes: 0 '***', 0.001 '**', 0.01 '*', 0.05 '.', 0.1 '.', 1

In the study, Anova test was applied to reveal the significant difference of each variable. P values in the Pr(>F) column indicate whether the effect of independent variables on dependent variables is statistically significant or not. Region and Form variables contain significant differences as a result of ANOVA analysis.

The stars () in the output indicate the significance of the p-values. For example, if "****" is represented by two stars, the p-value is less than 0.001 and this result is highly statistically significant.

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Table 3. Anova test evaluation of independent variables

Variables	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Region	1	8.5	8.54	23.670	1.22e-06***
Form	7	21.7	3.10	8.589	1.93e-10***
Gender	1	23.5	23.51	65.173	1.06e-15***

Signif. Codes: 0 '***', 0.001 '**', 0.01 '*', 0.05 '.', 0.1 '.', 1

In the study, the effect of the environment was questioned through dependent variables. Firstly, when the graphical data are evaluated in terms of the impression variable (Figure 5), the presence of the environment had a negative effect on the impressiveness of the forms. The opening form, conoid form, twisted form, circular form and hyperbol form, which were impressive when evaluated individually, took lower values when evaluated together with the environment. The simple form was evaluated as more impressive with the environment. However, as a result, the environment negatively affected the impressiveness of the forms. The impression of forms is lower in Ulus than in Kavaklıdere. This is related to the fact that the buildings shaping Ulus are low-rise, detailed, and ornamented facades. Tall building construction is considered less impressive in the historic environment than in the modern environment.

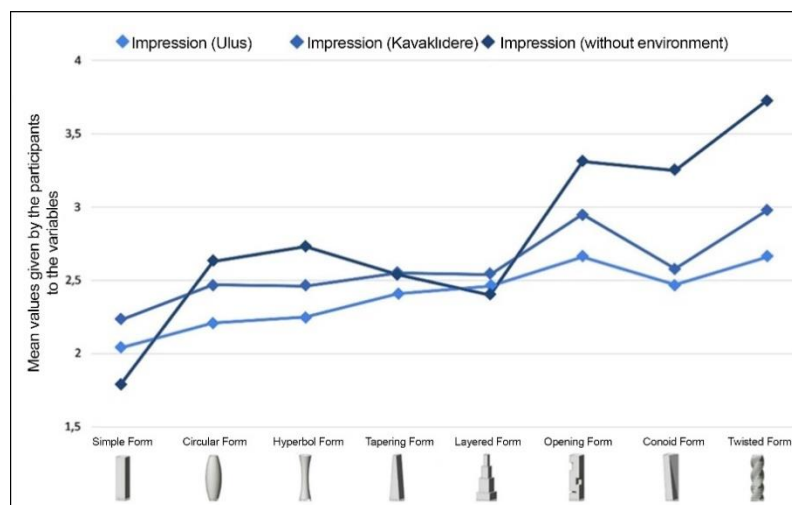


Figure 5. Average values of variables in terms of impression

When the graphical data is evaluated in terms of the complexity variable (Figure 6), the presence of the environment had a positive effect on the forms. All forms were evaluated as more complex with the environment. Simple, circular, hyperbol, tapering, layered and opening forms, which were considered complex with the environment, were found to be less complex when evaluated independently of the environment. In terms of conoid and twisted forms, the presence of the environment had no effect on complexity. In Ulus and Kavaklıdere, the results showed a similar distribution. Both regions have similar values in terms of complexity.

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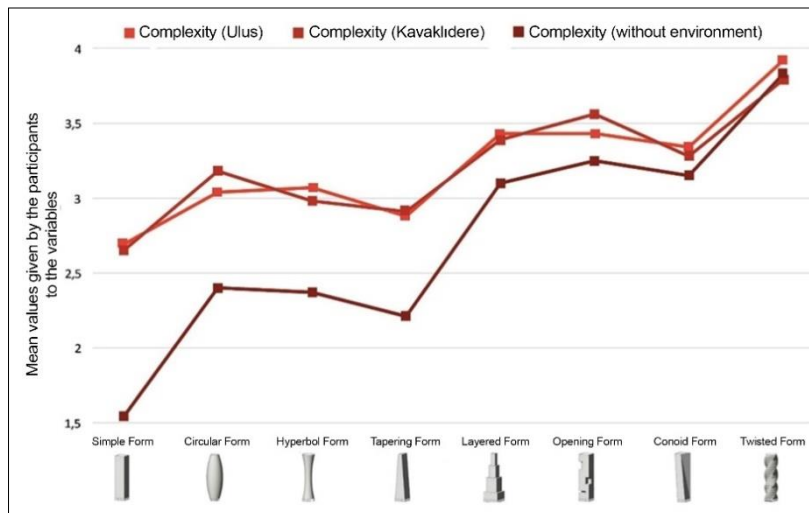


Figure 6. Average values of variables in terms of complexity

When the graphical data are evaluated in terms of the liking variable, the presence of the environment had a negative effect on the forms. When evaluated independently of the environment, the opening form, conoid and twisted forms were liked, while these forms received low values when evaluated together with the environment. When evaluated independently of the environment, the simple form was the least liked form, while it was liked when evaluated together with the environment. In addition, the Kavaklıdere district received higher values in terms of appreciation than Ulus. Tall building construction was liked more in the modern environment than in the historic environment. Therefore, the results in the graph show that the environment has a significant effect on the appreciation of forms. The environment decreases the impressiveness of the forms, increases their complexity, and decreases their liking. In the historical environment, the impression decreases, the complexity takes a neutral value and the liking decreases compared to the modern environment. Based on the results in the graph, it is understood that the environment has a significant effect on the perception and appreciation of the forms. The presence of the environment changes the level of complexity, impression and liking of buildings. The quality of the environment also has a significant effect on these variables. Tall buildings are more appreciated and more impressive in a modern environment.

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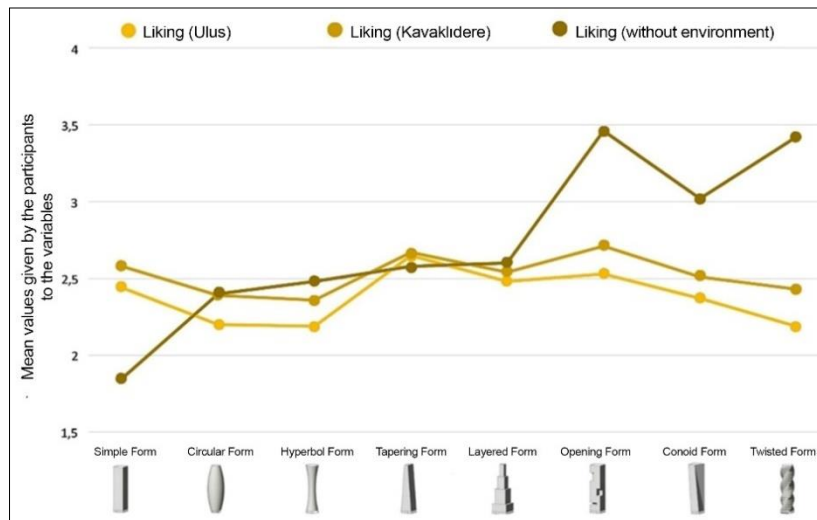


Figure 7. Average values of variables in terms of liking

4. CONCLUSION and RECOMMENDATIONS

In this study, the presence and quality of the environment in the perception and appreciation of tall buildings are questioned. Although the history of tall buildings dates back to ancient times, there has been a significant increase in the production of buildings all over the world in the 21st century. The fact that tall buildings reflect the economic development, modern and innovative aspects of cities and contribute to the prominence of cities globally has increased the importance of these buildings. In parallel with these developments, the visibility of buildings in cities has begun to become more noticeable. Based on the increasing importance of tall buildings, this study examines how the environment affects the perception and appreciation of these buildings. In this context, tall building forms were determined for the study and these forms were mounted in different environments. Then, the values of the buildings according to the variables of impression, complexity and liking were compared.

As a result, it was determined that the environment was effective in the evaluation of building forms. The addition of environmental data affected the perception and appreciation of the forms. It had a negative effect in terms of impressiveness and made the buildings perceived as more complex. In terms of liking, both environments had a negative effect. In other words, while the buildings were liked on their own, their level of appreciation decreased within an environment. This situation has developed independently of the quality of the environment. Even in a modern environment where tall buildings can be compatible, they are not appreciated as much as they are appreciated on their own. The quality of the environment also had a significant impact on the variables. Tall buildings are more appreciated and more impressive in a modern environment. Therefore, these results show that the environment is very effective on the perception and appreciation of buildings.

This study was conducted on high-rise buildings. In future studies, the results can be improved by examining different building types/styles. The environment variable was limited to modern and historical environment. More comprehensive data can be obtained by diversifying these variables (e.g. natural environment data can be added). In addition, determining the criteria by which the environment influences the perception and appreciation of buildings would contribute to the expansion of the findings obtained in this study.



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**DEGRADATION OF ORGANIC EXTERIOR COATINGS IN THE FACE OF
PHYSICAL ENVIRONMENTAL EFFECTS**

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ABSTRACT

All building materials have a limited lifespan and are subject to change and degradation over time, especially when exposed to the external environment. The durability of exterior claddings, which are constantly exposed to the external environment during the use process in buildings, has always been an issue that architects, building manufacturers, and users have always cared about. The main function of exterior claddings is to protect the substrate surface against corrosion and erosion. The duration of healthy use of exterior coatings varies depending on material quality, application quality and ambient conditions. This is called the durability of coatings. At the end of their useful life, they will be renewed. No organic or inorganic coating can last forever. Even inorganic coatings, such as electroplated coatings on aluminum, have limited durability. Organic exterior coatings used as topcoats on the facades of buildings are slightly more sensitive to physical environmental effects than inorganic coatings. The loss of protective properties of organic coatings generally occurs in two steps. The first of these is the decomposition of the material by physical environmental effects. The second is the loss of the ability of the coating to bond to the substrate as a result of attenuation and other effects caused by degradation. In this study, climate factors and related physical environmental effects will be defined, the factors among climate factors that are parameters for the deterioration of the properties of exterior pavements will be discussed, and the mechanisms that degrade organic structures and lead to adhesion weakening will be examined.

Keywords: Exterior Cladding, Physical Environmental Effects, Adhesion, Degradation.

1. INTRODUCTION

Organic exterior coatings are one of the material options that can be used as finishing on the exterior facades of buildings. As it is known, the main function of exterior coatings is to protect the substrate surface. For this, first of all, they must maintain their adherence with the substrate, be durable, and remain intact for as long as possible in the face of external environmental conditions.

Temperature changes, humidity, precipitation, U.V. radiation, pollution caused by oxygen and acid gases in the air are among the factors affecting the durability of an organic-based material faced with outdoor conditions. Among these, only oxygen is seen as a constant parameter. Other parameters may vary according to geography and regions and latitudes around the world.

When these regional effects listed above are considered in a wide area with their main lines, the concept called "macroclimate" emerges. For example, the Mediterranean climate is a macroclimate type. Furthermore, there is another type of climate that occurs on a small scale, very close to the building component in question, and plays an important role in determining the life of the material. This is called a "micro-climate". For example, dew formation is a



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microclimate type. With dew formation, a continuous film of water forms on surfaces, usually during the cool night hours or in the morning. A further effect in the neighborhood of the substrate is the accumulation of acidic ions in the wet film formed by dew.

Solar radiation provides the energy required for winds, evaporation, temperature, atmospheric and oceanic cycles and similar climatic events that manifest themselves in various ways on Earth and in the atmosphere. It can be said that solar radiation is the locomotive of all these events and movements that determine the macro-climatic conditions. In the microclimate dimension, solar radiation has an effect that increases surface temperatures and changes the nature of organic substances, leading to differentiation of their internal structure characteristics.

The first effect of solar radiation on surfaces is temperature. This effect is mostly caused by long wavelength infrared radiation. Depending on the thermal properties, the degree of roughness and the angle of incidence of the rays, any surface receiving the sun will heat up more or less than the ambient temperature and cool down during the night hours.

A more important effect of solar radiation, especially on organic surfaces, is to disrupt the microstructure of the material. This effect is caused by short-wavelength ultraviolet radiation. According to the view confirmed by many scientists, the high energy that destroys all organic products is mainly caused by U.V. radiation. U.V. radiation first of all changes the microstructure of organic molecules and then changes the physical properties of the material. (Eduardo & Real, 2023).

The loss of protective properties of organic coatings generally occurs in two steps. The first of these is the decomposition of the material with physical environmental effects. This event is also called degradation. Degradation formation is mainly caused by U.V. radiation, water and oxygen effect and pollutants in the atmosphere and manifests itself as loss of gloss, color change, surface dusting, thinning of the film layer, hardening and brittleness. The second is the loss of adherence of the coating to the substrate as a result of weakening and other effects caused by degradation. (Philip & Schweitzer, 1999; Schulz, 2008).

Degradation Mechanisms

The destruction of organic building materials by U.V. radiation occurs in two ways. The first of these is that U.V. radiation initiates a reaction opposite to the polymerization reaction in which small molecules combine to form large molecules. (see Figure 1) With this reaction, covalent bonds are broken and large molecules disintegrate into small molecules. These micro-scale decompositions can be recognized by touching the coating surface. This is called surface dusting (or chalking).

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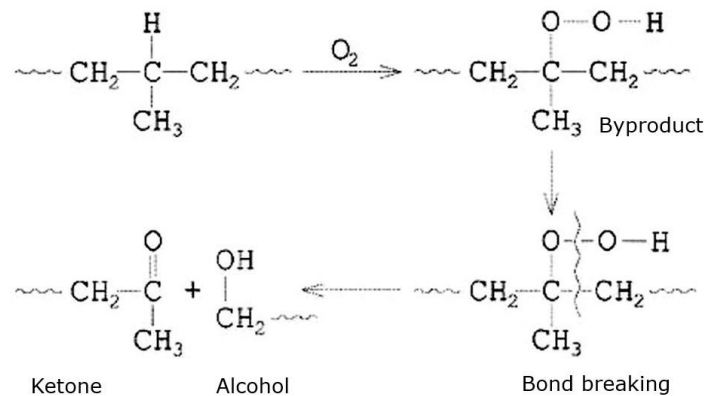


Figure 1. Bond breaking reaction

The energy provided by U.V. radiation, with the active help of oxygen and water vapor in the air, breaks the cross-linked macromolecules into smaller and smaller pieces. (see Figure 2) This continues for months and years until the polymer molecules are so small that they can be dissolved in water or turned into gases. The resulting molecules are CO or CO₂ gases. (Knudsen & Forsgren, 2017).

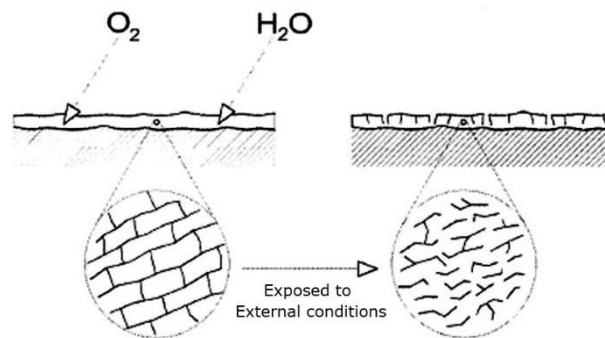


Figure 2 Degradation and breaking down of molecules

As this process continues, the volume of the coating layer shrinks, the film thickness decreases and it loses its durability. With the transformation of long elastic macromolecules into short brittle molecules, the film layer loses its elasticity, hardens and becomes brittle. This brittle process starts near the outer region of the film layer and after a certain time two different structures are formed within the film layer;

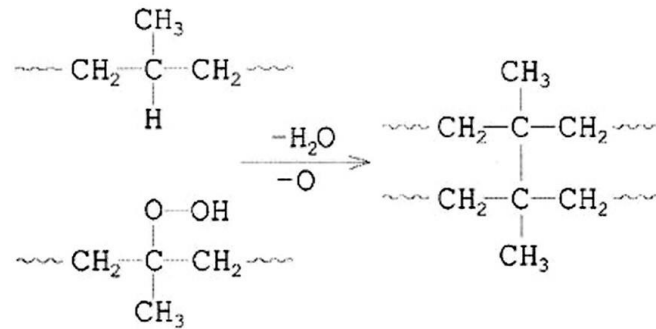
- The area close to the outside that has become hardened and brittle,
- Relatively more elastic inner region that has not yet hardened.

However, the basic principle in the construction of a wall is the opposite. The rigid and stiff part should be on the inside and the more elastic layers on the outside. If there is a brittle, quick-drying top layer on top of an elastic substrate, cracks are often formed. After a while these cracks deepen and accelerate the degradation into the interior. Eventually the entire film layer peels and breaks.

The second degradation mechanism is a reaction along the carbon chain in organic molecules, breaking side bonds and forming new ones. This results in large cross-linked molecules. (see figure 3) In this case, brittleness increases and capillary cracks occur. At the same time,

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molecules whose chemical structure changes during cross-linking cause more absorption of blue light in the visible region. Thus, the reflected light becomes closer to yellow. This manifests itself as a yellowing of the color when viewed from the outside. (Knudsen & Forsgren, 2017).



Cross-linking → Molecular expansion → Yellowing

Figure 3 Cross-linking and forming new molecules

Loss of Gloss

The first sign of structural deterioration of the coating film under outdoor conditions is dulling of the surface. After the application is completed, the coating surface may go through various phases such as full gloss, silky gloss, semi-gloss, semi-dullness and full dullness. (see figure 4) In the first phase, there is almost no light scattering on the smooth surface and the surface appears completely shiny. Meanwhile, the solvent evaporates into the air. The first phase may last a few weeks or a few months depending on the type of coating and weather conditions. At the end of this phase, the film layer loses the last solvent residues and signals the beginning of shrinkage. The large pigment groups pushed out of the surface during the initial shrinkage phase will scatter some of the light, causing a reduction in gloss of about 10%. This is normal for air-drying coatings. In the following phases, the scattering gradually increases and the surface becomes dull over time. (White et al., 2017; Philip & Schweitzer, 1999).

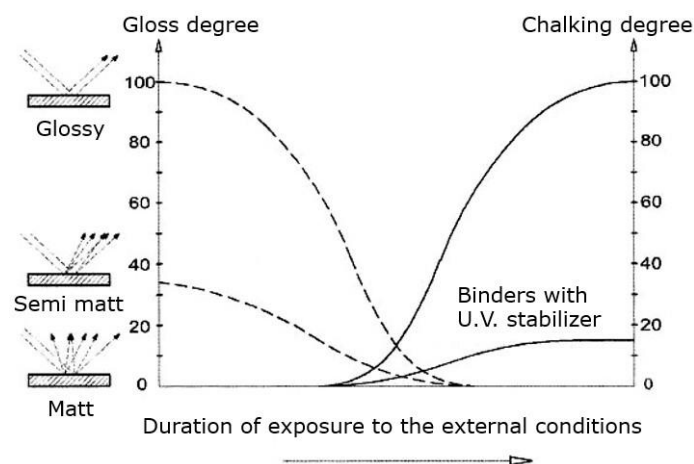


Figure 4 Time-dependent gloss loss and chalking curves on surfaces with different gloss levels (White et al., 2017)

The change in surface gloss over time can be easily determined. The gloss is measured at angles between 20° and 60° to the film surface and the reflection of light is measured periodically

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depending on the angle and the values obtained are compared with a reference value. The reference value is a standard black glass surface, which is considered to be 100% glossy. (Silva et al., 2016)

Surface Dusting.

Surface dusting is a visible sign of degradation. It occurs as a result of the release of unbound powdery pigment particles on the film surface of organic coatings under atmospheric conditions. This is also called chalking. Surface dusting in a white alkyd coating, pigmented with TiO_2 at 15% pigment/volume concentration, can be seen in figure 5.

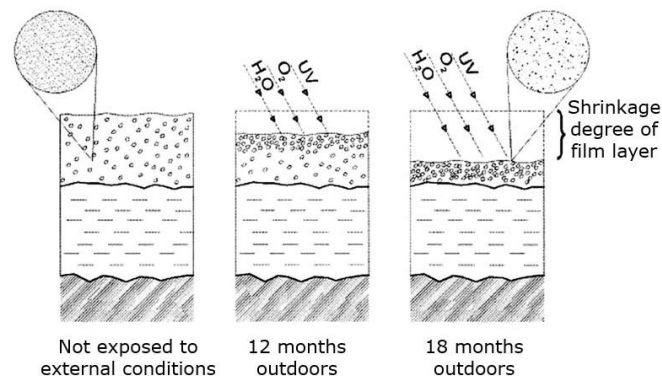


Figure 5 Surface dusting in a white alkyd coating (Philip & Schweitzer, 1999)

If we take a closer look at this phenomenon, 3 factors come to the fore: U.V. radiation, moisture in the air and Oxygen. When U.V. radiation combines with moisture and oxygen, the process of degradation of the organic structure begins. This manifests itself as surface dusting. The amount of moisture in the air and early morning dew play an active role in this process. The climates that cause the highest surface dusting effect are hot, humid and tropical climates with high U.V. radiation. In cold, cloudy, dry regions of the northern hemisphere or high mountains, surface pollution is relatively low. (Philip & Schweitzer, 1999; Schmid, 1988).

Decompositions and sheddings

One reason for the formation of cracks on the outer surface of air-dried coatings is the different drying rates of the layers. Under outdoor conditions, the outer zone dries faster than the inner zone. The pigment/volume concentration of the drying zone increases and the surface becomes more brittle. The high pigment/volume concentration of the brittle top layer on the more flexible substrate causes cracks. The brittleness of the outer layer is caused not only by the increase in pigment/volume concentration but also by the degradation of macromolecules. Intramolecular cross-linking and the degradation of binding molecules into smaller molecules lead to brittleness. In both cases, cracks appear in the outer layers of the paint layer. (Moncmanova, 2007)

Superficial cracks also occur when an incompletely dried oil primer is painted with a fast drying topcoat with a high pigment/volume concentration. These cracks lead to increased penetration of water, oxygen and U.V. radiation into the coating. This creates defective sections in the paint film layer, which accelerates the degradation of the paint system further inland. Eventually these cracks reach the substrate surface. Protection ends and corrosion and erosion of the substrate begins. After this stage, peeling and exfoliation begin.



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The effect of the first days on an air-drying coating

Coating systems drying under outdoor conditions are very sensitive to environmental conditions during the initial stages of drying and the first days after application play an important role for the entire life of the film layer. This makes it somewhat difficult to predict the durability of coating materials. For example, water can enter the film layer at night due to dew formation and this creates a swelling. These swelling movements disrupt and slow down the film layer formation. The film layer becomes porous and poorly crosslinked. On the other hand, a warm and dry climate accelerates the drying process and resistance to U.V. degradation is gained more quickly. (Schurr, 1982).

Loss of adherence

In order of importance, loss of adhesion always comes before surface degradation. Surface degradation can be repaired by repainting. However, exfoliation and peeling of a coating system due to loss of adhesion often requires expensive repairs. The damaged areas must be scraped away and a sound surface must be obtained ready for reapplication. It can therefore be said with certainty that maintaining adhesion is a fundamental requirement for a successful coating system. Regardless of all other properties, a coating with strong adhesion to the substrate under atmospheric conditions will show greater durability than a coating with weak adhesion.

Loss of adhesion usually occurs after the degradation process has started. Therefore, degradation is considered to be one of the direct or indirect causes of adhesion loss. However, the adhesion mechanism is quite complex and each coating system behaves differently depending on its type, substrate and external environmental conditions. For example, there are examples of coatings that lose adhesion long after degradation has started, as well as coatings that lose adhesion as soon as degradation begins. This situation shows that effects other than degradation play a role in adherence loss. These effects include mechanical stresses, temperature changes, humidity and chemical effects. (Schurr, 1982).

Mechanical stresses are tensile stresses or shear stresses that occur as a result of any external impact or force on the coating layer, or as a result of small deformations of the substrate. These stresses affect the adhesion forces at the interface and the internal structure of the coating material.

Another reason for the rupture of the coating layers from the substrate is the different thermal expansion requirements of the outer coating and the inner layer in the face of temperature changes. This is the physical effect of temperature on the material and depending on the magnitude of the stress it creates, it can cause the coating layer to break away from the substrate in a short time or after a certain period of time by fatiguing the material.

Another important influence that causes the adhesion of the pavement layer to the substrate to weaken is air humidity. The effect of moisture can occur through dew formation or condensation. Water molecules penetrating between the coating and the substrate block polar groups on the surface of the substrate and in the coating, so that the molecules cannot achieve the necessary adhesion. It can be said that in humid environments, the adhesion of the coating layer to the substrate will be weaker than in a dry environment.

Another cause of loss of adherence of the coating layer to the substrate is chemical effects. Reactions caused by the penetration of any chemical into the coating layer and absorption up to the interface, or electro-chemical reactions that cause the formation of ions as a result of



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water entering between the coating layer and the substrate can cause loss of adhesion. (Marrion, 2004; Stein & Lenz, 1973).

2. CONCLUSION

As a result, it can be said that the performance of organic exterior surface coatings depends on substrate and coating material properties, building envelope formation, application conditions and outdoor conditions. Therefore, when selecting the coating material, attention should be paid to be compatible with the substrate to which it will be applied and the climatic characteristics of the environment, to have the mechanical and physical properties expected from it, to be easy to maintain, renew and clean, to be durable and economical.

Internal and external effects within the external wall cause some physical phenomena to occur on the wall and this brings problems. Therefore, the layers that make up the wall must have some internal structure properties according to their location. When protecting buildings, applications are generally made by taking into account the visible signs on the exterior surface and impermeable materials are used as topcoat. These applications, which are made by ignoring the events in the inner layers of the facade, do not eliminate the cause of the physical events that destroy the building envelope from the inside and outside, and generally cause deterioration between the outer layer and the sub-surface and damage to the substrate together with the outer layer.

In the formation of the building envelope, water, moisture and salt carried by the plaster substrates should be prevented. For this purpose, wall layers should be selected so that capillary action and condensation do not occur in the exterior wall sections, if the application is made on a building that is still in use, condensation analysis should be performed, and if condensation occurs, it should be prevented with vapor barrier or heat insulation layers. The exterior cladding to be applied should have low water absorption and sufficient water vapor permeability. At the same time, organic facade coatings should be elastic enough to respond to small deformations and dimensional changes of the substrate and should be protected against U.V. radiation. It should be remembered that organic exterior coatings are sensitive to external influences in the early stages of drying, and that the environmental conditions during this time affect the entire life of the coating.

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**A RESEARCH TO DETERMINE SUITABLE PARK THEMES FOR THE CITY OF
AYDIN**

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ABSTRACT

Theme parks are recreational areas that are typically designed around a specific theme, often centered on scientific, cultural, or historical subjects. These parks aim to provide visitors with an immersive experience by presenting their entertainment offerings within a story or fictional setting. In addition to offering recreational, entertainment, and educational opportunities, theme parks also play a significant role in shaping urban identity, promoting tourism, fostering economic development, generating employment, and supporting green infrastructure. This study aims to identify theme park types that will contribute to the development of Aydın city and its residents, provide various recreational activities, and raise awareness about history, culture, and nature. To achieve this goal, a survey was conducted using the Delphi technique with a panel of 22 experts, including landscape architects, architects, agricultural engineers, urban and regional planners, archaeologists, and local government representatives in the region. The experts were presented with a questionnaire that consisted of both open-ended and closed-ended questions. The responses were thoroughly analyzed, and a second questionnaire was formulated based on the findings. This second questionnaire was sent back to the experts to reach a consensus. According to the results, the experts identified the following types of theme parks as suitable for Aydın city: "Educational Theme Parks and Gardens," "Natural Life-Themed Gardens," and "Recreation and Entertainment Theme Parks and Gardens." These themes were synthesized by taking into consideration Aydın's natural and cultural riches, and their suitability for the city was discussed. Recommendations were made for the implementation of a theme park that would enhance Aydın's prestige, and tourism potential, and appeal to all age groups.

Keywords: Park, Theme Park, Natural Landscape, Cultural Landscape, Urban Open Green Spaces



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1. INTRODUCTION

Cities are defined as complex structures that constitute a significant whole with their tangible and intangible cultural values. When describing these structures, especially open and enclosed spaces, along with focal points, are among the foremost tangible values. These areas not only contribute significantly to the formation of a city's identity but also continue to do so as long as they maintain their sustainability. However, it's not only the spatial aspects but also social and cultural elements that shape a city's identity. In this regard, parks, which serve as urban elements and social spaces, contribute to the creation of a city's green space system, reflecting urban culture, facilitating urban communication, and enhancing the city's quality of life (Çanga and Yücesoy, 2019).

Parks are classified into various categories based on their functions, service areas, and locations, and this classification determines their contribution to urban quality of life (Emür and Onsekiz, 2007; Bektaş, 2010). Ranging from large-scale regional parks to urban parks, neighborhood parks, and even theme parks, they serve different scales of urban life (Bektaş, 2010).

Theme parks, sprawling across extensive areas, can be described as entertainment centers that encompass both indoor and outdoor spaces, offering a wide range of activities and attractions. While the concept of theme parks has roots in Medieval Europe, today's theme parks are notably advanced and diverse. These parks make substantial contributions to the development of cities and countries by providing entertainment, cultural enrichment, and educational experiences to their visitors. They break the routine of urban life, enabling individuals to immerse themselves in fantasy and adventures. By blurring the line between reality and imagination, theme parks offer unforgettable experiences to city residents (Baran and Kont, 2014; Asensio, 2000; Deniz, 2002; Topaloğlu, 2007).

These spaces, which enhance the cultural and entertainment aspects of cities, contribute to the identity formation of urban areas and the overall quality of life, have become indispensable elements of modern cities. Theme parks provide visitors with opportunities for both entertainment and learning. Particularly, children can acquire new concepts and information through these activities. Moreover, theme parks frequently serve as significant tourist attractions, making substantial contributions to the local economy (Gök and Bingöl, 2017).

1.1. Classification of Theme Parks:

Deniz (2002) classified theme parks as follows;

- 1. Educational Theme Parks and Gardens:** This is the most common type of park among theme parks. Educational theme parks and gardens offer amenities such as libraries, laboratories, herbariums, exhibition areas, and educational activities to fully embrace the principles of education and research. An example of this type is the Prof. Dr. Aziz Sancar Mathematics and Science Park in Aydın Province.
- 2. Climate-themed Parks and Gardens:** These are enclosed areas that allow visitors to experience climates that are uncommon for the region due to methods like artificial heating, cooling, and climate control, providing conditions not typically found in their location. An example is the Cebra Ski Resort in Denmark.
- 3. History-themed Parks and Gardens:** These parks, found within theme parks, offer diverse activities by portraying the culture, history, traditions, architecture, beliefs, and lifestyles of



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different civilizations. They are usually established in regions associated with the civilizations they represent. The goal of history-themed parks and gardens is to immerse visitors in the feeling of living in that historical period. An example is Euro Park in England (Gök and Bingöl, 2017).



Prof. Dr. Aziz Sancar
Mathematics and Science
Park Aydin (Anonymous,
2021)



Cebra Ski Resort Denmark
(Anonymous, 2012)



Euro Park England
(Anonymous, 2023a)

Figure 1. Examples of parks and gardens with the themes of “Education”, “Climate” and “History”

4. Geography-themed Parks and Gardens: These parks aim to promote learning about the region and geography in which they are located, defining places and analyzing geographical events. An example of this theme is the Sultan Gazi Earthquake Education Park in Istanbul.

5. Recreation and Entertainment-themed Parks and Gardens: These areas are integrated into the urban structure, blending with nature and the surrounding landscape to create spaces where fantasy and entertainment converge. They feature various mechanical designs for entertainment and typically offer a combination of thrilling activities that challenge the imagination. Disneyland in France serves as an exemplary illustration of this theme.

6. Story, Fairy Tale, and Mythology-themed Parks and Gardens: These parks immerse visitors in the world of popular story, fairy tale, and mythology cartoon characters from both the past and present. They are adorned with a variety of cartoon-inspired architectural elements. An example of this theme can be found in Söke Wonderland, located in Aydın-Söke.



Sultangazi
Earthquake Education
Park Istanbul
(Anonymous, 2017a)



Disneyland Paris, France
(Anonymous, 2023b)



Söke Wonderland Aydın
(Anonymous, 2017b)

Figure 2. Examples of parks and gardens with the themes of “Geography”, “Recreation and entertainment” and “Story, fairy tale, mythology”

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7. Art-themed Parks: These theme parks and gardens exhibit artistic products both from the region and various other places. An example can be found at Miniaturk in Istanbul.

8. Hobby-themed Parks: These parks and gardens offer people the opportunity to engage in various hobbies with access to materials and spatial structures, especially for those who may not have the chance to pursue their hobbies in their daily living environments. Their popularity has recently been on the rise. An example is the Hobby Garden in Denizli.

9. Natural Life-themed Gardens: These are places where the endemic species and fauna diversity of the region are showcased. This type of theme park is established with the goal of raising awareness about and conserving endemic species. An example is the Izmir Sasalı Natural Life Garden.



Miniaturk Istanbul
(Anonymous, 2018)



Denizli Hobby Garden
(Anonymous, 2019)



İzmir Sasalı Natural Life
Garden (Anonymous,
2022a)

Figure 3. Examples of parks and gardens with the themes of "Art", "Hobby" and "Natural life"

10. Specially Expressive Gardens: These are reserved thematic areas within neighborhood, city, and district parks, designed on both large and small scales. Examples include rock gardens, dry stone gardens, and areas designed with special explanations for disabled individuals.

11. Age-themed Parks: These parks focus on the past and future, highlighting the past's influence on the present. They also play a role in preserving historical environments. An example of such a park is Ankapark in Ankara.



Rock garden Istanbul (Anonymous,
2023c)



Ankapark era theme example
(Anonymous, 2022b)

Figure 4. Examples of "Special Narrative" and "Age" theme parks and gardens

The aim of this study is to identify the types of theme parks that can contribute to the development of Aydın province and its residents. These parks should offer a range of recreational activities and promote awareness of history, culture, and science.



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2. MATERIALS and METHODS

2.1. Working Area:

In this study, we focus on Aydın province, which is situated in the Aegean Region of Turkey. Aydın province shares its borders with the neighboring provinces of Izmir, Manisa, Denizli, Muğla, and the Aegean Sea. As of 2022, Aydın has a population of 134,031, making it the third-largest province in the Aegean Region. The total land area of the province covers 8,117 km², with an average population density of 140 people per km². According to the 2022 data from the Turkish Statistical Institute (TUK), Aydın comprises 17 districts and municipalities, encompassing a total of 671 neighborhoods (Anonymous, 2022).

Aydın boasts a Mediterranean climate characterized by hot and dry summers, contrasted by mild and rainy winters. These climatic conditions, in conjunction with the region's topography, have given rise to two distinct plant communities: maquis and forest. In certain areas, the maquis vegetation starts right behind the coastal areas and extends to elevations of 500-600 meters. Particularly prevalent on the south-facing slopes and valleys, maquis communities gradually transition into forests at higher altitudes. These forests emerge at elevations of 500-600 meters on the mountainsides in both the north and south of the province. They consist predominantly of broad-leaved trees, primarily oak trees at lower elevations, and coniferous species such as red pine and larch trees at higher altitudes. Additionally, stone pines can be found in the Beşparmak and Madranbaba Mountains (Aydın Chamber of Commerce, Aydın Fig Sector Needs Analysis Report, 2016).

Aydın has a rich history marked by the presence of various ancient civilizations. Some of its prominent cities include Aphrodisias, Miletus, Didyma, Nysa, Priene, and Magnesia. The region's development can be traced back to around 2500 BC when the City of Tralleis was established during the Hittite period. Aydın flourished during the 8th century under the rule of Lydia and has been enriched with cultural assets and contributions from Turkish civilizations, including the Seljuk Dynasty. During the rule of Aydınoğulları, the city was known as Aydın Güzelhisar and was later renamed Aydın. In 1811, it became the provincial center, encompassing the sanjaks of Izmir, Saruhan (Manisa), Menteşe (Muğla), Antalya, and Isparta. After the War of Independence, Aydın became an independent province in 1923 (Anonymous, 2022).

Aydın province is renowned for its agricultural and tourism sectors. With a strong focus on agricultural product processing, approximately 55% of the population in Aydın derives their livelihood from the agricultural sector. Aydın leads the country in fig and chestnut production, ranking second in olive, cotton, artichoke, strawberry, and peanut production. Additionally, the province boasts a 150-kilometer-long coastline, making tourism its second major source of income.

Kuşadası and Didim are the primary tourist districts. The province is home to nine museums and 23 significant historical sites, both under the supervision of the Ministry of Culture and Tourism and privately managed.

Some of the notable archaeological sites in the province include Afrodisias (Karacasu), Alabanda (Çine), Alinda (Karpuzlu), Temple of Apollo (Didim), Gerga (Çine), Harpasa (Nazilli), Magnesia (Germencik-Ortaklar), Mastaura (Nazilli), Milet (Didim), Nysa (Sultanhisar), Priene (Söke), and Tralleis (Aydın-Efeler) (Anonymous, 2023).



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2.2.Methods:

The research primarily utilizes the Delphi Technique, a well-known method for decision-making and consensus-building. Alongside this approach, a comprehensive survey comprising both closed and open-ended questions was concurrently administered to experts. Survey data were subsequently analyzed using the Microsoft Excel program. Aydın stands out as a region renowned for its natural and cultural landscape potential. This region encompasses a diverse array of distinctive features that span various domains of expertise. To identify suitable themes for Aydın, it was imperative to solicit the consensus of experts and individuals well-versed in every facet of Aydın. Consequently, the Delphi Technique was employed as a systematic means to systematically gather insights and opinions from these experts to facilitate decision-making.

The following steps were undertaken in the research methodology:

I. Literature Review on the Subject: A comprehensive database was established by gathering up-to-date information on theme parks, the Delphi Technique, and Aydın province.

II. Selection of Panel Members (Participants): The study involved 22 panel members, encompassing landscape architects, agricultural engineers, city regional planners, architects, archaeologists, and local government representatives.

II. Development of the General Survey and the 1st Delphi Survey, and Distribution to Experts: The general survey included 19 closed-ended and 8 open-ended questions, focusing on assessing the experts' demographic profiles and their foundational knowledge regarding the subject. In the Delphi survey, experts were tasked with selecting the top 3 themes they considered suitable for Aydın City from a list of 11 thematic park categories. These surveys were administered to the panelists through face-to-face interactions.

IV. Development of the 2nd Delphi Survey and Distribution to Experts: The top 5 themes that garnered the highest votes in the 1st round were presented once more to the experts in the second round. They were asked to choose the three most fitting themes for the City of Aydın.

V. Evaluation of the Results: The analysis findings were merged with Aydın's natural and cultural landscape elements. Subsequent assessments were conducted, leading to the formulation of recommendations

3. FINDINGS and DISCUSSION

3.1. Findings From General Surveys

The Delphi Survey was conducted with 22 individuals who are experts in urban planning and design. This team consists of 7 landscape architects, 2 architects, 5 agricultural engineers, 4 city regional planners, 2 archaeologists, and 2 local government representatives. Among this expert group, 54.6% were women, and 45.4% were men. In terms of age distribution, 45% of the experts were in the 41-50 age group, 22% were in the 31-40 age group, 13% were in the 20-25 age group, 13% were in the 51-60 age group, and 4% were in the 26-30 age group.

Experts responded to the first question of the survey, which asked, "What do you think are the differences between theme parks and neighborhood, district, and city parks?" Their answers were analyzed, and it was concluded that the majority of experts (70%) are knowledgeable about the distinguishing features of theme parks compared to neighborhood and city parks.



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The second question posed to the experts was, "Which theme parks do you know, see, or hear about?" Experts provided examples of well-known theme parks, with Disneyland (36.36%), Vialand (13.64%), Miniaturk (13.64%), Legoland (9.09%), Viasea (4.55%), and Sazova Science Culture and Art Park (22%) being highlighted as prominent theme park brands.

The third question asked the experts to share their opinions on "Which theme park they think is suitable for the city of Aydın, among the parks they are familiar with." Among their responses, theme parks such as Disneyland (36.36%), LegoLand (9.09%), and Sazova Science Culture and Art Park (54.55%) were mentioned.

The fourth question is, "Is a theme park a commercial or public space?" It addresses whether theme parks are commercial or public spaces. The majority of experts (95%) stated that theme parks are currently planned with a commercial focus, but they pointed out that they should be public spaces.

The fifth question is, "Who should manage a theme park?" It includes a question about the management of theme parks. The majority of experts (90%) emphasized that the management of theme parks should belong to the public.

The sixth question is, "Should there be brand-name facilities and venues within the boundaries of the theme park that will compete with the theme of the park?" It addresses whether branded facilities should be part of the theme park. The majority of experts (75%) stated that branded facilities and venues should be included in the theme park but should not overshadow the main theme of the park.

The seventh question is, "Which of the parks in Aydın do you think has thematic features?" It asks experts to identify parks with thematic features. Experts mentioned parks such as Adaland (26.32%), Prof. Dr. Aziz Sancar Mathematics and Science Park (63.16%), and Wonderland Park (10.53%) as examples of parks with thematic features.

In the eighth question, the experts were asked to describe their dream theme park for Aydın with the belief that it would come true. They expressed their opinions, and based on their answers, it was determined that their dream parks mostly consist of Recreation and Entertainment Themed parks (33.33%), where all age groups can spend time together and have fun. Natural Life Themed Gardens (19.05%), where people can connect with nature, Art Themed Parks (9.52%), featuring miniatures of symbols reflecting the historical culture of the city of Aydın, Story, Fairy Tale, and Mythology Themed Parks with models of fairy tale heroes. There were also Parks and Gardens (9.52%) with elements showing the historical development of the city of Aydın, and finally, Entertainment Theme Parks (19.05%), where they prioritize the inclusion of film and TV series elements.



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Table 1. “Describe your dream theme park for Aydın, with the belief that the park of your dreams will come true?” Themes represented by the answers to the question

Theme	Percentage rate (%)
Recreation and Entertainment	33,33
Naturel life	19,05
Art	9,52
Story, Fairy Tale, Mythology	9,52
History	9,52
Entertainment	19,05

In the surveys, social, economic, security, recreation, ecological, aesthetic and functionality dimensions were asked to be evaluated in the design of theme parks. The opinions of experts on these issues are presented in Table 2.

Table 2. Expert opinions on social, economic, security, recreation, plant selection, aesthetics and functionality dimensions in the design of theme parks

	Question	Yes (%)	No (%)	No Idea (%)
Social	<u>A theme park in Aydın should serve all age groups.</u>	86,40	13,60	0
	<u>In a theme park in Aydın, activity areas should be divided according to age groups.</u>	77,20	22,80	0
	<u>A theme park in Aydın should serve different users in terms of education level.</u>	54,60	31,80	13,60
	<u>There should be indoor social areas in a theme park in Aydın.</u>	81,80	18,20	0
Economic	<u>Entrance to a theme park in Aydın must be paid.</u>	45,40	50,00	4,60
	<u>A certain percentage of the entrance fees received from a theme park in Aydın should be used within the scope of the social responsibility project.</u>	64,00	27,20	9,20
	<u>Entrance fees from a theme park in Aydın should only be used for the benefit of that park.</u>	59,00	31,80	9,20
Security	<u>Every user of a theme park in Aydın should be able to use it around the clock.</u>	45,40	50,00	4,60
	<u>In a theme park in Aydın, all kinds of security measures should be taken in terms of park management.</u>	100	0	0
Recreation	<u>A theme park in Aydın should only allow for active recreation.</u>	9,20	86,60	9,20
	<u>A theme park in Aydın should only allow for passive recreation.</u>	4,60	77,20	18,20



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Plant Selection	<u>A theme park in Aydin should allow for both active and passive recreation.</u>	90,80	0	9,20
	<u>Endemic plants should be used in a theme park in Aydin.</u>	90,80	4,60	4,60
	<u>Exotic plants should be used in a theme park in Aydin</u>	72,80	13,60	13,60
Aesthetics and functionality	<u>The reinforcement elements used in a theme park in Aydin should be different from the usual classical reinforcements.</u>	90,80	9,20	0
	<u>A theme park in Aydin should have plastic elements suitable for the theme of the park.</u>	63,60	36,40	0
	<u>In a theme park in Aydin, completely natural aesthetics should predominate.</u>	63,60	27,20	9,20

According to Table 2, the majority of experts agree that a theme park designed in Aydin should have social benefits. They advocate that it should cater to all age groups (86.4%) and that the activity areas in the park should be divided based on age groups (77.2%). More than half of the participants (54.6%) believe that a theme park in Aydin should serve users with varying education levels, and the majority (86.8%) insist that there should be indoor social areas within the theme park.

When it comes to the economic aspect of a theme park in Aydin, the experts' opinions vary. They do not fully agree on the issue of imposing entrance fees to the park. According to the results, 50% of the experts argue that there should be no entrance fee, while 45.40% disagree. However, the majority of experts believe that a certain percentage of the entrance fees should be allocated to social responsibility projects (63.6%) and that the entrance fees should be utilized solely for the benefit of the park (59%).

Regarding the security aspects of designing a theme park in Aydin, experts hold differing views. There is no consensus on whether the theme park should be open 24/7, as 50% of the experts believe it does not need to operate round the clock, with 4.60% abstaining. Nonetheless, all experts unanimously agree that comprehensive security measures should be implemented concerning park management.

As a result of the experts' evaluations regarding the design of a theme park to be constructed in Aydin with a focus on recreation, the majority of experts agreed that a theme park should not be limited to just active recreation (88.6%) or passive recreation (77.2%). Instead, it was determined that they believe it should accommodate both active and passive recreation (90.8%).

In terms of plant selection for a theme park in Aydin, the experts' evaluations are as follows: the majority of experts emphasized the use of endemic plant species in the park (90.8%), along with the incorporation of exotic plant species (72.8%).

When it comes to the aesthetic and functional aspects of the design of a theme park in Aydin, experts provided the following insights: the majority expressed the need for equipment elements that differ from the typical classical equipment (90.8%), the inclusion of plastic elements in



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harmony with the park's theme (63.6%), and a predominance of natural aesthetic elements throughout the park (63.6%).

3.2. Fundings From the Delphi Survey

In the 1st Round of the Delphi survey, experts were presented with 11 park themes and various theme parks, along with an "other" option, allowing them to add their own suggestions. They were then asked to select their top 3 choices.

The total number of participants for the options presented to the experts can be calculated as the "number of experts" multiplied by the "number of preferences." In this case, with 22 experts participating and each selecting 3 preferences, the total number of participants in the choices presented in the first round was $22 \times 3 = 66$. Since the evaluations are based on the number of choices made by participants, the frequency distribution in the first-round Delphi surveys includes 66 responses. The results obtained are provided in Table 3.

Table 3. Round I. Delphi survey evaluations

PARK THEMES	Participation	Distribution (%)
Art-themed Parks	12	18, 1
Natural Life-themed Gardens	12	18, 1
Recreation and Entertainment-themed Parks and Gardens	11	16, 6
Educational Theme Parks and Gardens	8	12, 1
Story, Fairy Tale, and Mythology-themed Parks and Gardens	6	9
History-themed Parks and Gardens	5	7, 5
Climate-themed Parks and Gardens	4	6, 0
Hobby-themed Parks	3	4, 5
Geography-themed Parks and Gardens	2	3, 3
Age-themed Parks:	2	3, 3
Other	1	1, 5
Specially Expressive Gardens	0	0
TOTAL	66	100

Among the park themes presented in the 1st Round, the five most preferred options were Art Theme Parks (18.1%), Natural Life Theme Parks and Gardens (18.1%), Recreation and Entertainment Theme Parks and Gardens (16.6%), Education Theme Parks and Gardens (12.1%), and Story, Fairy Tale, Mythology Theme Parks and Gardens (12.1%). To facilitate the formation of a consensus among the expert group, the top 5 most preferred park themes were presented once again in the 2nd Round, and the experts were asked to select their top 3 preferences. The preference results are detailed in Table 4.



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Table 4. Round II. Delphi survey evaluations

PARK THEMES	Participation	Distribution (%)
Educational Theme Parks and Gardens	17	25, 7
Natural Life-themed Gardens	14	21, 3
Recreation and Entertainment-themed Parks and Gardens	14	21, 3
Art-themed Parks	11	16, 6
Story,Fairy Tale, and Mythology-themed Parks and Gardens	10	15, 1
TOTAL	66	100

When analyzing the 2nd Round Delphi survey conducted with experts, it was observed that the most favored park theme, with a 25.7% preference rate, was Education Theme Parks and Gardens. Following closely in the second and third positions were Natural Life Themed Gardens and Recreation and Entertainment Theme Parks and Gardens, both with a preference rate of 21.3%.

It's worth noting that Natural Life Themed Gardens, which were the top preference in the 1st Round, dropped to the second position in the 2nd Round. On the other hand, Education Theme Parks and Gardens, initially ranked fourth in preferences, became the most favored park theme in the second round. Meanwhile, Recreation and Entertainment Theme Parks and Gardens, which secured the third position in the first round, maintained its standing in the second round.

4.CONCLUSION and RECOMMENDATIONS

Theme parks exert a profoundly influential impact on a city, making their accurate selection a matter of utmost importance for the city's identity and tourism potential. The chosen theme must harmonize with the city's natural and cultural assets while fostering a positive impression among both tourists and locals. Moreover, the theme's potential to contribute to sustainability and conservation should be a consideration. Consequently, an interdisciplinary approach is essential when determining park themes, with a focus on reaching a consensus among experts. In doing so, the chosen theme stands a better chance of gaining acceptance and successful implementation by all stakeholders in the city.

To determine suitable theme parks for Aydın, a panel of 22 experts was assembled. The Delphi technique was employed to gather insights from this expert group, involving a two-round process. In the first round, experts were presented with 11 diverse theme park options and asked to select their top 3 choices. The results of the first round highlighted the 5 most favored theme parks, namely "Art-themed parks" and "Natural life-themed gardens," which each garnered 18.1% preference, followed by "Recreation and entertainment-themed parks and gardens" at 16.6%, and "Educational Theme Parks and Gardens" at 12%. "Story, fairy tale, mythology-themed parks and gardens" received 9% preference.

The second round prompted experts to choose 3 out of 5 theme parks, aiding in the determination of the most suitable options. As per these results, the most fitting theme parks



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were identified as "Educational Theme Parks and Gardens" at 25.7%, "Natural life-themed gardens" at 21.3%, and "Recreation and entertainment-themed parks and gardens" at 21.3%.

Although "Education Theme Parks and Gardens" initially ranked fourth in the first round of the Delphi technique survey, it surged to the top spot in the second round. This shift in preference can be attributed to experts' prioritization of the conscious education of future generations. Furthermore, it is believed that educational theme parks can offer both enjoyable and instructive experiences.

While "Natural Life Theme Parks" shared the first place in the first round of the survey, they slipped to the second position in the second round. This change is likely due to the expert group's increased emphasis on the need for educational theme parks. Additionally, highlighting Aydın's endemic species and natural beauty played a significant role in the selection of this theme park.

The selection of "Recreation and Entertainment Theme Parks" is estimated to be motivated by the existing recreational and entertainment theme parks in Aydın province that are not functioning as expected. Additionally, these parks are seen as potential contributors to the economic development of the city.

In addition to these results, some of the following ideas and suggestions can be evaluated for the successful implementation of theme parks to be established in Aydın city:

When theme parks around the world and in Turkey are examined, it is seen that park design can be shaped according to the natural and cultural characteristics of the region. For this reason, it is of great importance that the theme park to be designed for Aydın is suitable for the natural and cultural riches of the region. Aydın's natural plants, rich historical and cultural heritage can be highlighted in the content of the theme park. Traditions, handicrafts and cuisine of the local people can be exhibited in the theme park, contributing to the local economy and providing a cultural experience. It may be possible to offer cultural and artistic content by creating museums and exhibition areas within the park. These spaces can support local artists and cultural heritage.

Educational Theme Parks and Gardens came to the fore in Aydın. These types of parks can provide fun learning opportunities for children and adults. Wildlife parks can likewise serve educational purposes and instill nature conservation and environmental awareness in visitors. In addition, this park can be designed within the framework of an understanding that respects Aydın's natural beauties and environmental values. Sustainability principles such as green energy use, water conservation, waste management and biodiversity conservation can be integrated into the design of the theme park. However, providing interactive experiences using technology can make visitors find the park more impressive. Smartphone applications, virtual reality experiences or thematic mobile guidance services may be considered.

In addition to these suggestions, the success of theme parks is closely dependent on the strategic decisions taken by local governments regarding park planning and design, implementation and sustainability. For this reason, local governments should conduct comprehensive market research to determine which target audience the parks appeal to and which age groups and interests they target. Demand analysis plays an important role in shaping the park's content and activities. Additionally, an effective marketing and promotion strategy should be developed before and after the opening of the park. Social media, websites, local events and media collaboration can be used for this purpose. Additionally, social responsibility projects can be



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supported in the park, and projects such as environmental cleaning activities, educational programs or aid campaigns can increase the social impact of the park.

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**EXAMINATION OF AMASYA UNIVERSITY HAKIMIYET CAMPUS' POTENTIAL
TO BECOME A SUSTAINABLE AND GREEN CAMPUS**

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ABSTRACT

With the Industrial Revolution, the advancement of technology, and the increase in migration from rural to urban areas, cities have developed in an unplanned and infrastructure-deficient manner. This has led to an increase in concrete areas and a decrease in green spaces in cities. Consequently, this situation has resulted in the depletion of natural resources, disruptions to ecosystems, the exacerbation of global warming, and an increase in environmental pollution and chemical waste. To ensure the sustainability of limited natural resources, sustainability policies such as the use of environmentally friendly transportation systems, waste reduction, and the utilization of renewable energy sources have gained importance. Planning and designing university campuses in accordance with these policies will make significant contributions to using natural resources effectively and minimizing negative impacts on the environment. This study aims to explore the potential of the Amasya University Hakimiyet campus in the central district of Amasya to become a sustainable and green campus. In this direction, the concepts of sustainability and green campus were defined and the parameters required for the campus to be a sustainable and green campus (waste management, water management, green and sustainable transportation, green buildings, green areas and plant presence, energy management and green infrastructure) were examined through qualitative field observations. The status of the campus is evaluated, and recommendations are made to achieve ecological, social, and economic sustainability based on the findings.

Keywords: Sustainable Campus, Green campus, Amasya University Hâkimiyet Campus, Amasya.

1. INTRODUCTION

After the Industrial Revolution, with the development of technology and the increase in rural-to-urban migration, population growth and urbanization movements have occurred. As a result, cities have developed under unplanned and inadequate infrastructure conditions. Consequently, the rate of urbanization has increased, and the quantity of green areas (road trees, urban forests, campuses, agricultural areas, green areas, roofs, etc.) has been reduced due to factors such as housing construction and road construction, leading to an increase in urbanization. This situation has led to the deterioration of the ecosystems, an increase in global warming, the expansion of the ozone hole, and an increase in environmental pollution and chemical waste.



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Due to the increasing consumption of natural resources over time and insufficient production, there has been a growing awareness that finite natural resources will eventually be depleted. As a result, serious efforts have been made in many parts of the world to find solutions for ensuring their sustainability and continuity. In this context, a policy of environmentally compatible sustainability has come to the forefront with the aim of establishing a healthy cycle in the natural-human-social system.

Sustainability means maintaining diversity and productivity and protecting people's ability to survive (Holmberg & Sandbrook, 1992). The concept of sustainability was accepted at the Stockholm Conference in 1972, which was the first global assessment in the field of environment, and the concept was first used officially in the Brundtland Report titled *Our Common Future* prepared by the United Nations Commission on World and Environmental Development (WCED) in 1987 (Kurt Konakoglu & Usta, 2019). In this report published by the United Nations in 1987, it is emphasized that to ensure sustainability, there should be a strong connection between ecological, social, and economic components, and growth among these components should be balanced and controlled. In this context, universities, which are places where scientific studies are carried out, contemporary approaches are developed and universal knowledge is produced, have important roles in ensuring sustainability. This role, which started with environmental education in universities, was shaped by the Talloires Declaration after the declaration held in France in 1990 (Ak, 2022). At the same time, in the new urbanization concept, important steps such as reducing waste consumption, utilizing renewable energy sources, and adopting motorless transportation systems are necessary to ensure the sustainable development of cities (Kurt Konakoglu & Usta, 2019).

Throughout history, universities have provided education in various fields and locations. Over time, changes have occurred within universities because of the socio-cultural differences in society and evolving societal needs. Consequently, in line with the needs, a single structure in which education was provided at universities was replaced by campus models formed by many structural mechanisms (Özipek, 2018). The concept of campus is defined as a multifunctional educational area where university education buildings, student dormitories, faculty members' residences and social facilities, walking paths outside these structures, streets, green areas, inner courtyards, and squares are located (Ayvaci, 2009). According to Hasol (1998), the concept of campus is defined as large areas where university education buildings, student dormitories, faculty housing, sports and social facilities are located together. It is thought that campuses, which contain the characteristics of cities, can be areas where the concept of sustainability can be easily applied, as they are places that can develop rapidly and easily adapt to globalization and technological developments (Kurdoglu & Çelik, 2016; Bayramoglu & Kurdoglu, 2018; Gömeli, 2018; Kurdoglu et al., 2018a; Kurdoglu et al., 2018b; Kurdoglu et al., 2018c; Kurdoglu et al., 2018d). At the same time, campuses that provide housing, work, leisure, and transportation functions promote the efficient use of energy and water conservation, utilization of rainwater, renewable energy usage along with green buildings, and the enhancement of environmental quality and green network structure. This leads to gains in ecological, social, and economic aspects. (Güllü et al., 2012; Kurt Konakoglu & Usta, 2019).

With the implementation of necessary planning and design approaches within the scope of sustainable development on university campuses, new university models have emerged, and universities have started to be referred to as 'eco-friendly universities,' 'sustainable universities,'



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'eco-campus,' 'green campus,' 'environmentally friendly campus,' 'sustainable campus,' 'smart campus,' 'eco-conscious campus,' and 'climate-sensitive campus' (Ak, 2022).

Sustainable campuses are places where actions required to preserve the integrity of natural systems are carried out under an institutional identity. They also serve as living laboratories where a wide range of activities related to energy, transportation, education, food, water, innovative and environmentally friendly technology production, and more are implemented and demonstrated (URL-1, 2021). Green campuses, on the other hand, are defined as places where adverse environmental impacts are minimized, public awareness of sustainability is created, and the teaching and research functions of higher education institutions are fulfilled (Dahle & Neumayer, 2001). Sustainable and green campuses are an approach where a university's activities are ecologically sound, socially, and culturally equitable, and economically feasible (UNEP, 2013).

In the Sustainable Campus Declaration (ISCN-GULF), published in cooperation between the International Sustainable Campus Network (ISCN) and the Global University Leaders Forum organized by the World Economic Forum, three fundamental principles of the sustainable and green campus approach, which are holistically inclusive and hierarchical (sustainability of buildings), impacts, campus-wide planning and goal setting, integration of research-teaching and outreach) were determined (Global University Leaders Forum & International Sustainable Campus Network, 2010). In the Greening Universities Toolkit prepared for sustainable and green campuses, the necessity for universities to be ecologically, sociologically, and economically sustainable is emphasized (UNEP, 2013).

The planning and design of sustainable and green campuses are possible through the management of a comprehensive and long-term process. In this process, establishing planning principles for sustainable and green campus areas is achievable by identifying the problem and addressing it within the framework of infrastructure, management, and operations (Özdal Oktay et al., 2015). Velazquez et al. (2006), Alshuwaikhat et al. (2008), Ağı Günerhan et al. (2016) created a model proposal that can be used in sustainable and green campus planning and design processes. The approach of supporting ecological processes in the planning and design of sustainable and green campuses involves utilizing green infrastructure practices/approaches, which include landscape ecology principles and planning and design methods (Ak, 2022). In order to establish green infrastructure in sustainable and green campuses, it is necessary to utilize rainwater and wastewater, incorporate renewable energy-focused designs that enhance energy efficiency into campus planning, and use plant species that are suitable for climate and soil conditions. This way, a comprehensive sustainable approach can be achieved. (Güllü et al., 2012; Büyükkurt, 2019).

The Green Measurement (UI GreenMetric) System was developed by the University of Indonesia in 2010 to evaluate sustainability activities on campuses and encourage universities towards sustainability (UI GreenMetric Kılavuzu, 2017). UI GreenMetric system is a self-assessment tool that reveals the status of universities regarding sustainability and green campuses. This tool contributes to education and academia in universities on sustainable and green campus practices (Akpulat, 2019). UI GreenMetric system is an environmental sustainability model that generally consists of environmental, economic, and social parameters. The environmental aspect includes the use of natural resources, environmental management



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and pollution prevention, the economic aspect includes profit and cost, and the social aspect includes education, society, and social participation (UI GreenMetric Kılavuzu, 2018).

Velazquez et al. (2006), Alshuwaikhat et al. (2008), Ağı Günerhan et al. (2016) and the UI GreenMetric System, sustainable and green campus parameters are: waste management, water management, green and sustainable transportation, green buildings, green areas and plant presence, energy management and green infrastructure. *Waste Management*: Universities that produce a significant amount of recyclable waste, especially paper, plastic, electronics, and metals, generate waste materials based on consumption. However, it is possible to contribute these waste materials back to the economy through recycling. Therefore, universities can not only create an economic resource for themselves through recycling activities but also assume an encouraging role by sharing an exemplary practice with other public and private institutions (Sahin et al., 2016). *Water Management*: Green infrastructure systems have gained particular importance in recent times, especially in the context of contemporary planning and design principles focusing on water management and conservation. In this regard, both the evaluation of landscapes and the provision of sustainable benefits from landscapes have become significant. Within urban infrastructure systems, the presence of landscaping is integrated to slow down, direct, and functionalize the excess water accumulated on impermeable surfaces in urban areas before it enters surface runoff. In this context, green infrastructure practices that can be used for rainwater management on university campuses can be listed as rain gardens, rain trenches, artificial wetlands, and green roofs (Büyükkurt, 2019).

Green and Sustainable Transportation: Transportation systems, while providing socio-economic benefits to societies, also bring various negative impacts in social and environmental terms. In traditional transportation systems, non-recyclable fuels are heavily used, the balance of benefits and costs is unevenly distributed, those without vehicle ownership bear many costs without reaping benefits, and transportation becomes an economic burden on governments, businesses, and households. Additionally, factors such as traffic congestion and irregular land use have led to an increasingly inefficient transportation system, resulting in adverse consequences for the environment and quality of life. In this context, the pursuit of balancing the benefits of transportation with its negative effects has given rise to the concept of 'sustainable transportation' (Cirit, 2014). In recent years, the bicycle has become an indispensable element in sustainable transportation due to the increasing energy consumption resulting from the intensification of private vehicle usage, which is both energy-efficient and cost-effective, for addressing environmental issues (Cengiz et al., 2016).

Green Buildings: Buildings are significant components of sustainable development due to their ecological, economic, and sociological impacts. In this context, green buildings that assist settlements in developing sustainably can be defined as elements (Dogan et al., 2018). Sustainable and green university campuses are areas where many structures are integrated with each other. Considering the development of environmentally friendly policies, high energy efficiency in energy consumption, and waste reduction within these areas, green buildings are considered important components of a green campus (Ak, 2022). *Green Areas and Plant Existence*: A campus's character is determined by the architectural structures, green spaces, and their relationships and coherence with each other on the campus. Campus green spaces play an important role in balancing the relationship between users and nature and improving campus living conditions. In this sense, in the sustainable green campus approach, the quantity and quality of green spaces a university campus possesses are considered important indicators of



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the university's sustainable development. In this context, in sustainable university campuses, planning and design efforts that provide suitable campus living spaces for users' psychological and physical needs and ecological benefits become significant (Gül & Küçük, 2001).

Energy Management: Obtaining energy from limited fossil resources in nature leads to negative impacts on ecosystems and human health, causing irreversible harm. Therefore, the importance of energy conservation, the use of renewable energy sources, and energy efficiency and management has emerged to reduce the adverse effects of energy consumption on ecosystems and human health (Usma et al., 2019). Campuses, barracks, residential areas, or complexes with many buildings, such as university campuses, are high-energy-consuming areas. Such campuses, depending on their potential, are areas that require energy efficiency and energy conservation as they generate high carbon dioxide emissions in direct proportion to their energy consumption and costs (Sögüt et al., 2015). *Green Infrastructure:* Green infrastructure is a system approach that connects fragmented natural and cultural landscape areas within the urban concept, creating an open-green network system and establishing a balance between the natural and cultural fabric within the urban concept (Tokmak, 2021). From a functional perspective, green infrastructure systems provide solutions that support ecosystems, encourage sustainability with ecological, sociological, and economic benefits, and offer conservation and recovery. In this sense, the goal of the green infrastructure approach is to support, protect, and enhance ecosystems and biodiversity (Kaylı & Günes Gölbe, 2020). Rain gardens, permeable pavement coverings, vegetated swales, green roofs, and infiltration tanks are all part of green infrastructure applications (Torres, 2010; Jaber et al., 2012; Sert, 2013; Tikansak, 2014; Müftüoğlu & Perçin, 2015; Demirkır, 2019). This study aims to examine the potential of the Amasya University Hâkimiyet campus, located in the central district of Amasya province, to become a sustainable and green campus. In this context, the concepts of sustainability and green campus are defined, and the parameters required for the campus to become a sustainable and green campus (waste management, water management, green and sustainable transportation, green buildings, green spaces and plant diversity, energy management, and green infrastructure) are examined through qualitative land observations. The data obtained from the campus are analyzed, and recommendations are provided to achieve sustainability and green campus objectives.

2. MATERIALS and METHODS

In this study, the Amasya University Hâkimiyet Campus, located within the boundaries of the central district of Amasya province, was chosen as the study area. The Hâkimiyet Campus, selected as the study area, is situated on Muhsin Yazıcıoğlu Avenue. The campus consists of the Faculty of Education A-B-C Blocks, a conference hall, the central library building, the Rectorate building, and sports fields (Figure 1). It is located approximately 2.5 km from the city center of Amasya. It is within walking distance of the city center, and access to the city center by motor vehicle via Muhsin Yazıcıoğlu Avenue takes approximately 7 minutes.

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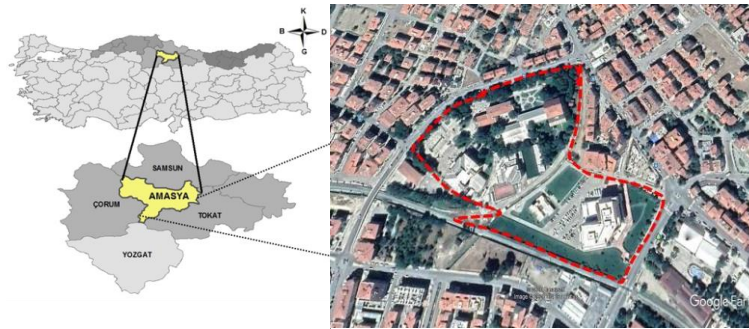


Figure 1. Study area boundaries

In this study, information on the concepts of sustainability and the green campus was acquired, and a field study was conducted to determine the current state and infrastructure of the campus through qualitative land observations. The parameters required for the campus to become a sustainable and green campus (waste management, water management, green and sustainable transportation, green buildings, green spaces and plant diversity, energy management, and green infrastructure) were examined, and the data obtained from the campus were analyzed. As a result of these analyses, how transportation, energy resources, and waste management are provided within the campus, as well as which plant species and pavement materials are used on the campus, were elucidated. The results obtained from the previous steps were discussed, and the current state of the campus was evaluated, leading to the development of recommendations for ecological, social, and economic sustainability.

3. FINDINGS and DISCUSSION

Velazquez et al. (2006), Alshuwaikhat et al. (2008), Ag Günerhan et al. (2016) and sustainable and green campus parameters determined according to the UI GreenMetric System (waste management, water management, green and sustainable transportation, green buildings, green areas and plant presence, energy management and green infrastructure) at Amasya University It was evaluated on the example of Hakimiyet Campus and the findings are as follows:

Amasya University Hakimiyet Campus includes academic buildings (Faculty of Education A-B-C Block), administrative buildings (Rectorate building) and socio-cultural buildings (conference hall, central library building) (Figure 2). The campus transportation infrastructure consists of vehicle and pedestrian roads. Car parks, which constitute an important element of the transportation system, are positioned parallel to the vehicle road. There is a large parking area near the Rectorate building and the library building. The floor covering of this area is concrete pavement, which is an impermeable floor. There are no bicycle paths within the campus. The campus has a slightly sloping land structure that is almost flat. In the study conducted by Kurt Konakoglu & Keskiner (2021), the lowest point of the campus is 392 m, which connects the Rectorate building to Hakimiyet Street, and the highest point is 420 m, which connects the Faculty of Education Block C and Muhsin Yazıcıoğlu Street m. There are no waterways, water elements, rain gardens, or rain ditches within the campus. The campus green area system consists of the parts outside the campus buildings and transportation networks. In the study conducted by Kurt Konakoglu & Keskiner (2021), green areas in the campus are in the elevation range of 392-420 m (Figure 2). In terms of the topography of the campus, there is a 28 m height difference between the lowest and highest points. The Faculty of Education Block A-B-C, the conference hall, the library building the Rectorate building and

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the parking areas in the immediate surroundings of the building, the sports fields area, and the areas outside the motor vehicle roads and pedestrian paths constitute the green area of the campus. On the campus, there are grass areas and shrub groups between 392 and 400 m elevations, deciduous trees and shrubs, shrub and evergreen plant taxa between 400-410 m elevations and evergreen trees and shrubs between 410-420 m elevations. During the field studies, 30 different plant taxa, including 16 deciduous trees and shrubs, 8 evergreen trees and shrubs, and 6 shrubs, were identified in Amasya University Hakimiyet Campus (Table 1).



Figure 2. Amasya University Hâkimiyet Campus current situation analysis



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Table 1. Plant taxa in Amasya University Hâkimiyet Campus (Kurt Konakoglu & Keskiner, 2021)

	Scientific Name	English Name	Family
Deciduous Trees and Shrubs	<i>Acer campestre</i>	Field Maple	ACERACEAE
	<i>Acer negundo</i>	Manitoba Maple	ACERACEAE
	<i>Acer platanoides</i>	Norway Maple	ACERACEAE
	<i>Albizia julibrissin</i>	Silk Tree	LEGUMINOSAE
	<i>Catalpa bignonioides</i>	Southern Catalpa	BIGNONIACEAE
	<i>Cercis siliquastrum</i>	Judas Tree	LEGUMINOSAE
	<i>Juglans regia</i>	English Walnut	JUGLANDACEAE
	<i>Malus floribunda</i>	Japanese Flowering	ROSACEAE
	<i>Morus nigra</i> 'Pendula'	Weeping Mulberry	MORACEAE
	<i>Paulownia tomentosa</i>	Empress Tree	PAWLONIACEAE
	<i>Platanus orientalis</i>	Oriental Plane Tree	PLANTANACEAE
	<i>Prunus cerasifera</i> 'Pissardii	Purple-Leaf Sand Cherry	ROSACEAE
	<i>Robinia pseudacacia</i>	Black Locust	LEGUMINOSAE
	<i>Salix babylonica</i>	Weeping Willow	SALICACEAE
	<i>Tilia tomentosa</i>	Silver Linden	TILIACEAE
<i>Quercus robur</i>	English Oak	FAGACEAE	
Evergreen Trees and Shrubs	<i>Calocedrus decurrens</i>	Incense Cedar 'Aurea'	CUPRESSACEAE
	<i>Cedrus atlantica</i> 'Glauca	Weeping Blue Atlas Cedar	PINACEAE
	<i>Cupressocyparis leylandii</i>	Leyland Cypress	CUPRESSACEAE
	<i>Cupressus macrocarpa</i>	Monterey Cypress 'Topiary'	CUPRESSACEAE
	<i>Nerium oleander</i> 'Thij'	Oleander 'Thij'	OLEACEAE
	<i>Picea pungens</i> 'Hoopsii'	Hoops Blue Spruce	PINACEAE
	<i>Pinus nigra</i>	Austrian Pine	PINACEAE
<i>Pinus sylvestris</i>	Scots Pine	PINACEAE	
Shrubs	<i>Buxus sempervirens</i>	Common Boxwood	BUXACEAE
	<i>Euonymus japonica</i>	Japanese Euonymus	CELASTRACEAE
	<i>Euonymus japonica</i> var.	Japanese Euonymus 'Aurea'	CELASTRACEAE
	<i>Ligustrum vulgare</i>	Common Privet	OLEACEAE
	<i>Nerium oleander</i>	Oleander	OLEACEAE
	<i>Rosa chinensis</i>	Chinese Rose	ROSACEAE

4. CONCLUSION and RECOMMENDATIONS

Universities have a sizable population consisting of students, and academic and administrative staff, along with structural elements such as green spaces, roads, buildings, and parking areas. University campuses, resembling small towns, are known to consume significant amounts of resources like energy and water, with high levels of carbon emissions, like a small city. This situation has direct or indirect negative effects on both humans and the environment. Given the adverse impact of university campuses on the environment and human health, it is of utmost importance for these campuses to be sustainable, not only to reduce their polluting factors but also to set an example and lead the community in pollution reduction efforts (Günerhan & Günerhan, 2016; Ak, 2022). Since sustainability is a long-term process, the primary goal in sustainable campuses is the rational use of natural resources, the second goal is ensuring long-term continuity, and the third goal is setting an example for the city in which they are located



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(Büyükkurt, 2019). University campuses play a significant role in addressing the problems encountered in today's cities (Günerhan & Günerhan, 2016).

For a university to be considered sustainable, it must engage in sustainable activities, and these activities should be embraced by all campuses of the university. In this regard, it is important that all elements that make up the university, such as the structure of administrative and educational buildings on campus, transportation within the campus, campus landscaping, waste management, the use of plants on campuses, and the use of energy sources, are constructed in a manner that promotes sustainability.

On campuses, sustainability is achieved by using renewable energy sources for irrigation, heating, and hot water supply, collecting rainwater through drainage channels for watering plants on the campus, utilizing energy-efficient lighting fixtures, implementing green building and green roof practices, incorporating solar panels on building surfaces or rooftops, using permeable pavements on walkways and vehicle roads to facilitate rainwater absorption, promoting bicycle and pedestrian transportation to reduce the carbon footprint on the campus, reducing hard surfaces and increasing the number of green spaces with climate-appropriate plant species, and ensuring waste recycling (UC Davis, 2021).

In this study, Velazquez et al. (2006), Alshuwaikhat et al. (2008), Ağı Günerhan et al. (2016) and the sustainable and green campus parameters (waste management, water management, green and sustainable transportation, green buildings, green areas and plant presence, energy management and green infrastructure) determined according to the UI GreenMetric System, Amasya It is seen that zero waste and recycling practices are supported at the University Hakimiyet Campus.

There are no waterways, water features (ponds, pools, wetland areas, etc.), rain gardens, rain ditches, vegetated swales, or wastewater recycling systems on the campus in terms of water management and green infrastructure. It is observed that there is no green and sustainable transportation system on the campus, and transportation within the campus relies on motor vehicles, resulting in high greenhouse gas emissions. Although bicycle usage is common in the city, it is not preferred by academic and administrative staff as well as students within the campus. Therefore, there is no bicycle infrastructure, bicycle lanes, or bicycle parking areas within the campus. The ground surfaces outside the green areas on the campus are covered with impermeable concrete. Despite its potential, there are no green buildings, green roofs, or green parking lot practices implemented on the campus. Of the total campus area of 53,129.79 m², 41,271.00 m² consists of hard surfaces, while 11,858.79 m² is green space. Within the green areas of the campus, 30 different plant taxa have been identified, including 16 deciduous trees and shrubs, 8 evergreen trees and shrubs, and 6 bushes. Many of these identified plants have low water requirements, which can lead to excessive water consumption on the campus, surpassing its actual needs. It is observed that evergreen trees and shrubs, as well as bush groups, are predominantly used around the campus boundaries, while large grassy areas are present in the vicinity of the Rectorate Building.

Based on the findings obtained from the analyses conducted in the study, the following recommended practices can be implemented for Amasya University Hâkimiyet Campus to become a sustainable and green campus:



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- A 'Sustainability Office' should be established on the campus to carry out sustainability-related initiatives.
- Rainwater should be collected in rain gardens or retention basins and treated for use in watering plants to minimize water consumption on the campus.
- Existing impervious surfaces in parking lots, ceremonial areas, and vehicle and pedestrian pathways should be replaced with permeable pavement to facilitate rainwater absorption.
- Green roof applications should be integrated into campus buildings and landscapes to reduce the urban heat island effect.
- Solar panels can be installed on the Rectorate Building, an administrative building within the campus, which receives ample sunlight compared to other buildings, and green building practices can be implemented.
- Perennial ground cover plants that are suitable for the Amasya climate, resistant to cold in winter, and capable of withstanding sun exposure in summer with low water requirements should be preferred for the open green spaces on the campus and areas near the buildings.
- To raise awareness among students about sustainability, courses related to sustainability can be added to the curriculum of each department, and student clubs can be established.

The results obtained from the study indicate that Amasya University Hakimiyet Campus lacks waste management, water management, green and sustainable transportation, green buildings, energy management, and green infrastructure according to sustainable and green campus parameters. It is believed that when these measures are successfully implemented, Amasya University could potentially be included in the Green Metric list.

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**ANALYSIS OF THE BUILDING-STREET RELATIONSHIP CONCEPT IN
ARNAVUTKÖY, BEBEK, AND BEŞİKTAŞ ÇARŞI REGIONS**

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ABSTRACT

How a street is viewed and perceived is determined by the user as well as the surrounding structures and the relationship of these structures to the street. The quality of a building is affected by the mass relationship or transition between the street and the building. In the analysis of the building-street relationship, dimensions and masses of the buildings, elevations of the entrance doors to the street, building distances from the parcel contour, facades, usage of the ground floor and the condition of the building blocks relative to each other are considered. Building-street relationship concept is a parameter that should be included in the urban design and building design processes and evaluated with an inter-scale perspective. This study was developed within the scope of the "Keep the Beşiktaş District Alive" project carried out with Beşiktaş Municipality. The concept of building street relationships in the study is analyzed in Beşiktaş Çarşı, Arnavutköy and Bebek. The study consists of concept analysis, current situation analysis and recommendations. In the concept analysis, building-street relationship; in the current situation analysis, the field investigations and complaints obtained as a result of face-to-face interviews with the residents of Beşiktaş Çarşı, Arnavutköy and Bebek districts; in the suggestions section, the suggestions of the author and residents of the neighborhoods and the solution suggestions produced in the workshop held with the architecture students are included. The study aims to determine and evaluate the problems of the neighborhoods examined in the Beşiktaş district, in the context of building-street relationships.

Keywords: Urban Design, Building-Street Relationship, Street Typology.

1. INTRODUCTION

Urban morphology, which has an important place in research conducted within the scope of urban studies, is a branch of science that examines urban form. It examines the changes that the urban texture elements of the physical environment such as building blocks, street textures, and full-empty ratios have undergone in the formation and historical process within the scope of socio-spatial variables (Kubat, 2018). Carter, on the other hand, defines urban morphology as the examination of the internal structure of the city (Carter, 1983).

In his research, Kropf (2011) emphasized the orientation of urban morphology studies to understand, organize, transform, and manage the structure and complexity of the built environment. While it is not possible to observe some changes covering a large area in the formation process of the urban space, the changes occurring at the scale of a single parcel or building block can be observed concretely. These changes, which usually take place gradually, can be observed in the shape of the building block, parcel dimensions, structuring order, and

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building heights (Ayan, 2010). The independent components that make up the urban morphology are expressed in Figure 1.

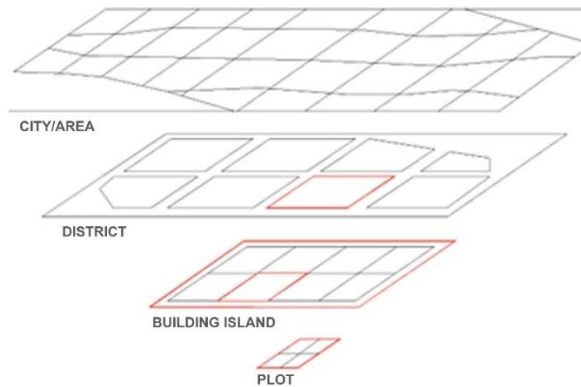


Figure 1. Urban morphology

The building block, which is one of the components of the urban morphology, consists of adjacent parcels with a circulation area around it and no streets passing through it. The building block appears as the basic form determinant. The building block layout is determined by the size and mass relations of the buildings, the location of the buildings relative to the street and their relations with the street, and the relations of the buildings with each other and with their gardens.

Within the scope of this study, which was developed within the scope of the "Keep the Besiktas Neighborhood Alive" project carried out with the Municipality of Beşiktaş, the relationship between the building island, street, parcel and building in the middle and lower scales was emphasized, and in this context, the concept of building-street relationship, which can be considered at the building island scale, was examined. The building-street relationship is discussed in Arnavutköy, Beşiktaş Çarşısı and Bebek Districts. The study consists of three parts: concept analysis, current situation analysis and recommendations. In the first part, the concept of building-street relations and the things examined within the scope of this concept are introduced. In the second part, Arnavutköy, Beşiktaş Çarşısı and Bebek districts are examined in the context of the building-street relationship, and the user opinions obtained within the scope of the "Keep Your Neighborhood Alive" project realized with Beşiktaş Municipality are also included. In the third part, suggestions were made as a result of the examinations. It is aimed to determine and evaluate the problems of the neighborhoods examined in the Beşiktaş district, in the context of building-street relationships, serving as a guide for the study.

The Concept of Building Street Relationship

A successful city has streets that people can relate to. How a street looks and feels is determined by the structures around it. The quality of a building is strongly influenced by the nature of the approach or transition between the street and the building (Auckland Council, 2022). The concept of the building-street relationship is examined at the scale of the building block, which is one of the components that make up the urban morphology. The building-street relationship is determined by the size and mass of the buildings, the elevations of the entrance doors relative to the street, their facades, their distance from the parcel outline, the use of the ground floor, and the situation of the building blocks relative to each other. By examining these features,



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information can be obtained about the width of the streets, street typology, their efficient use, and access to natural light.

According to Van Nes and Yamu (2021), the first of the main factors of the building-street relationship is the spatial structure of the street network of the built environment, and the second is the micro-scale spatial relationship between private and public spaces. In urban studies, micro-scale spatial relationship concerns the interrelationship between buildings and street sections. It concerns how building openings are connected to the street network, that is, the degree of topological depth from private to public space and the mutual visibility between doors and windows on the streets. According to Jacobs (1960) and Gehl (1996), entrances and windows should face the street to ensure liveliness in the streets. The density of windows and entrances, which provide a direct connection between buildings and the street, is one of the factors that affect the degree of security in urban areas. The way entrances and windows are positioned on facades and their relationships with each other on both sides of the street affect the degree of social control, natural surveillance, perception of security, and street life (Van Nes and Yamu, 2020) (Figure 2).



Figure 2. Different types of facades (Van Nes & Yamu, 2021)

Adjacency and permeability levels of building facades are important in terms of having a positive building-street relationship (Hillier & Hanson 1984). If the entrance of a building can be directly accessed from the street, this constitutes a safe street. However, buildings with blind facades, buildings with only a few windows facing the street, or buildings with only entrances facing the street can be said to be negative in terms of the building-street relationship, as they create the perception of an unsafe street. This spatial relationship between private and public space has an impact on the vitality of street life in urban areas (Van Nes & López, 2010). But, since building entrances can be located at the same level as the street, at a lower level, or a higher level, depending on the project and the topography, during the design and implementation process, the possibility of entrance stairs creating intrusive action on the streets should be taken into account. Entrances to buildings, that is, private areas, may not be directly connected to streets. There are many semi-public or semi-private spaces between a private space and the public space represented by the street. Front gardens can be given as examples of these areas. If an entrance is directly connected to a public street, it has no semi-private or semi-public spaces between the private and the public spaces. This situation is explained by the concept of topological depth (Van Nes & Yamu, 2021) (Figure 3).

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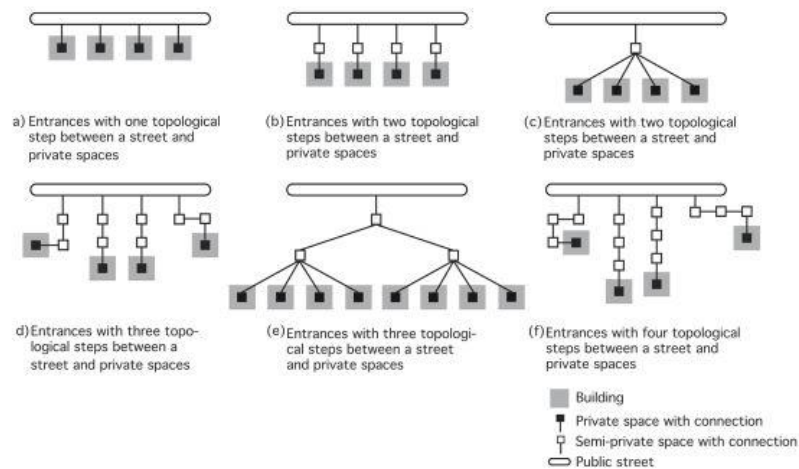


Figure 3. Various topological depths between private and public spaces (Van Nes & Yamu, 2021)

Apart from building facades, entrances, draw distances and gardens, different functions located on the ground floors are also examined in the context of the building-street relationship. According to Gehl (1936), a lively city gives a friendly and welcoming signal to its users along with social interaction. For this reason, it can be said that the presence of entertainment venues such as cafes and restaurants on the ground floors of the buildings interact with the streets and create lively public spaces. However, the different functions located on the ground floors may cause the area to turn into an area where people are not happy to be unless the environment is taken into account and designed accordingly. For this reason, buildings and streets should be considered together.

Examination of Arnavutköy, Bebek, and Beşiktaş Çarşısı Neighborhoods in the Context of Building-Street Relationship

Within the scope of the project, field trips were organized to Beşiktaş Çarşısı, Arnavutköy and Bebek regions. As a result of the field trips, the relationships of the buildings in the region with the street were examined and reported. After preliminary research, it was aimed to obtain direct opinions from the residents of the district. In the meetings held with the residents of the district on April 15, 2022, in Arnavutköy, on April 22, 2022, in Beşiktaş Center, and on June 2, 2022, in Bebek, solution tables were established and the problems experienced by the users regarding the district were discussed and records were kept. At the end of the interviews, surveys containing the criteria of the approach and principles created for this study were applied to the residents of the district, and data about the districts were collected in a certain systematic way. In this part of the study, the data obtained as a result of field trips and interviews with district residents are presented.

Examination of Arnavutköy Neighborhood in the Context of Building-Street Relationship

Arnavutköy is a neighborhood of Beşiktaş district, with Bebek in the north and Kuruçeşme in the south. The name of Arnavutköy District has changed many times from past to present. In ancient times, it was named "Hestai" because of the lime kilns on the hill. During the Roman period, when Consul Promotos settled here, it was first called "Promotu" and then "Anaplous". After the village accepted Christianity, Ayios Mikhailaion Church was established and the



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name of the district was changed to "Mikhailaion". In the following years, it was called "Horasmoto" meaning "Village of Angels". There are various opinions among historians about where the current name of Arnavutköy comes from. According to some historians, the name of the district comes from the Janissaries of Albanian origin who were assigned to protect the district after Fatih Sultan Mehmet conquered Istanbul in 1453, and according to some historians, it was named after the janissaries of Albanian origin in the 19th century. It was named after the cobblestone masters brought by Sultan Abdülmecid in the 16th century. Although most of the buildings in Arnavutköy belong to the 20th century, some of them were built in the Art Nouveau style. Although there are reinforced concrete structures in the district today, the historical buildings are generally wooden houses (Figure 4, 5).



Figure 4- 5. Historical buildings of Arnavutköy neighborhood (Tekkol, 2021)

Arnavutköy neighborhood, together with Bebek, Kuruçeşme, and Ortaköy, constitutes the core of the Beşiktaş district. Although Beşiktaş district has undergone various urban transformations since the republican period until today, these transformations have largely led to the formation of settlements such as Levent, Zincirlikuyu, Nispetiye, and Etiler, and no large-scale changes have been made in the regions that form the core of the district (Çağlayan, 2020). In this way, it is possible to see the neighborhood order of the Ottoman period in the Arnavutköy neighborhood today. Due to the proximity of building blocks and parcels to each other in the region, narrow streets, which are characteristic of Ottoman neighborhoods, are observed (Figure 6).

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Figure 6. A historic map of Arnautköy (Kitantik)

In the study, the part shown on the map below for the Arnautköy neighborhood was examined, observations were made on this region and suggestions were given (Figure 7).

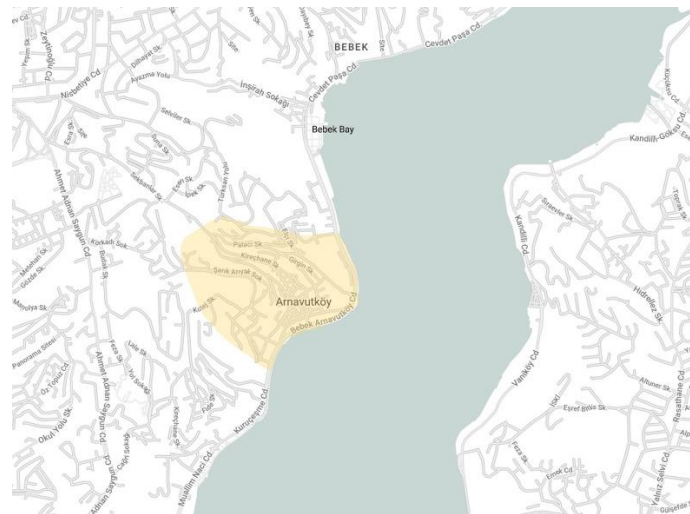


Figure 7. Studied area for Arnautköy Neighborhood (Snazzy maps)

Arnautköy neighborhood generally consists of historical buildings. These buildings have bay Windows (Figure 8). Bay windows, which are generally located on the second and third floors of buildings, protrude onto the streets, and this creates the perception of a safe street for users. However, it has also been observed that the buildings being adjacent to each other and their retreat distances create narrow streets causing the streets not to receive sufficient daylight.



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Figure 8. Historical buildings of Arnavutköy

The front or back garden, which is generally found in traditional Turkish houses, does not exist in most of the buildings in Arnavutköy. Since the entrances of the buildings open directly to the street, their relationship with the street is direct (Figure 9). In other words, the building-street hierarchy dominates the neighborhood.

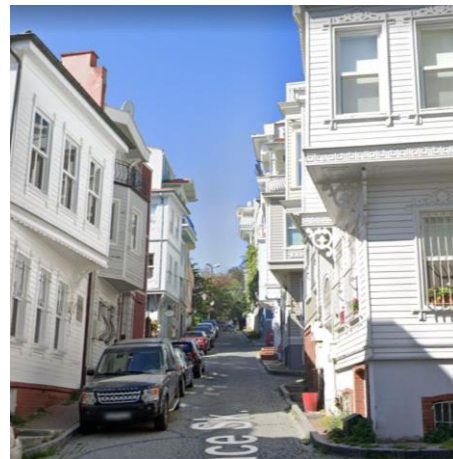


Figure 9. Entrances of the buildings opening directly to the street (Google Maps)

Depending on the topography of the area, as you move north, it is seen that the building entrances are higher than the street level and the entrances to the buildings are provided by stairs. Row houses, which were built in some parts of Istanbul in the past, are also located in the Arnavutköy neighborhood. There are examples in these houses where the ground floor is higher than the zero level. Therefore, in some streets in Arnavutköy, buildings whose entrances can be reached by stairs have been observed, not because of the topography of the region, but because the ground floors are located at higher elevations. These structures were found in Teyyareci Suphi Street and Arnavutköy Dere Street (Figure 10- 11).

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Figure 10. A building entrance in Teyyareci Suphi Street (Google Maps)



Figure 11. Building entrances in Arnavutköy Dere Street (Google Maps)

Buildings whose entrances are higher than the street level act intrusively on the sidewalks due to their stairs. Stairs extending from outside the building to the pavements interrupt pedestrian circulation. This situation causes the building's relationship with the street to be negative in the context of user movements. However, it does not hinder the directness of the building's relationship with the street. The fact that the building entrance stairs extend directly from the building to the street proves that the buildings and the streets are inseparable and should be considered together.

There are shops, cafes, and restaurants on the ground floors of the buildings located on Bebek-Arnavutköy Street and on Beyazgül Street, Dubaracı Street, and Sales Square Street, which are close to this street. These functions, which emphasize public use, perceptually strengthen the relationship of the buildings with the street by reinforcing the publicity of the streets for the users of the area. At the same time, it enables users to feel safe on the streets, which are public spaces, by providing activity on the streets (Figure 12, figure 13). However, the functions located on the ground floors intensify human circulation in the area, causing vehicle traffic to increase. This situation makes the relationship of the buildings with the street indirect and turns it into a structure-vehicle-street hierarchy.



Figure 12- 13. Ground floor usage in Arnavutköy Neighborhood (Google Maps)



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Examination of Beşiktaş Çarşı Neighborhood in the Context of Building-Street Relationship

Beşiktaş Çarşı district, which is located in Beşiktaş district, is known as Sinanpaşa District. However, due to the region's place in urban memory, it is also known as Beşiktaş Bazaar among the public. The district is surrounded by Cihannüma, Türkali, and Vişnezade districts and the Bosphorus. Sinan Pasha Mosque, from which it takes its name, Barbaros Hayreddin Pasha Tomb and square, and Istanbul Maritime Museum are within the borders of this region. The neighborhood is located at the intersection of Barbaros Boulevard, Beşiktaş Street and Çırağan Street. The neighborhood can be reached by means of transportation such as ferries and buses.

Sinan Pasha, who was the captain of the Ottoman Navy between 1550 and 1553, gave his name to the neighborhood. Sinan Pasha Mosque, built by Mimar Sinan and located within the borders of the region, took its name from Captain Admiral Sinan Pasha. It is known that in the 17th century, Beşiktaş Park and its surroundings, where the Barbaros Monument is located, was a submerged bay. This bay was filled and turned into a private garden for the rest and entertainment of the sultans. Mansions and pavilions were built in this garden in various periods and the Beşiktaş district began to develop rapidly (Figure 14). From that period onwards, the name Beşiktaş; started to be used for the region including Sinanpaşa and its surrounding districts. Thus, the district formerly known as Beşiktaş is now known as Sinanpaşa district. As Beşiktaş continues its development along the coastline, Sinanpaşa district has also started to become a neighborhood. Today, it is the busiest and central region of Beşiktaş district.

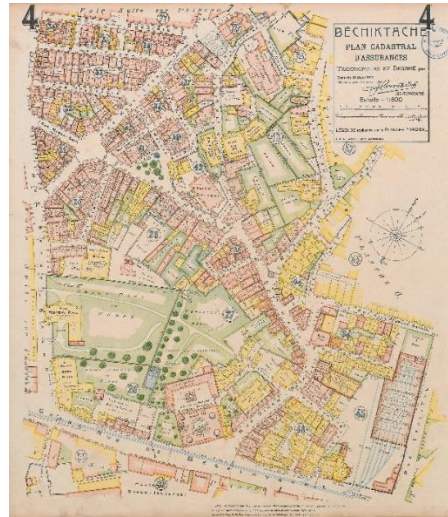


Figure 14. Pertvititch Map of Beşiktaş Çarşı (Sinanpaşa) (Salt Araştırma)

In the study, the part shown on the map below for the Beşiktaş Çarşı (Sinanpaşa) neighborhood was examined, observations were made on this region and suggestions were given (Figure 15).

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Figure 15. Studied area for Beşiktaş Çarşısı (Sinanpaşa) (Snazzy Maps)

Beşiktaş Çarşısı, also known as the Sinanpaşa neighborhood, which is the busiest area of the Beşiktaş district, has some differences from other regions examined in the study in terms of building-street relationships and building functions. The abundance of public transportation opportunities and its connecting nature with other neighborhoods have made the region the busiest neighborhood of the district. The density in the region has shaped the functions of the buildings. It has been observed that very few of the buildings here are used as residences. As a result, more shops were found on the ground floors of the buildings compared to the other neighborhoods examined in the study. The fact that building functions generally consist of shops, cafes, and restaurants is the determining factor in the relationship of buildings with the streets in the region. Although the different uses on the ground floors provide activity on the streets, tables, chairs and various store elements act intrusively on the streets by restricting pedestrian circulation (Figure 16, figure 17).



Figure 16- 17. Ground floor usage in the district (from the Author's Camera)

The intrusive action of buildings with commercial and entertainment functions on the streets negatively affects the building-street relationship in the context of user perception. In addition, buildings with different functions create vehicle density in the narrow streets that are currently formed due to the proximity of parcels and building blocks to each other and cut off the connection of the buildings with the street. This situation creates the structure-vehicle-street hierarchy and makes the relationship of the building with the street indirect. It has been observed that the gaps formed due to the difference in levels between the entrances of some

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buildings in the Beşiktaş Bazaar area and the sidewalks disrupt the pavement axis and create difficulties for disabled individuals. Generally, the entrances of the buildings are higher than the level of the pedestrian walking area on the street, sidewalk, and bazaar, and they are reached by 3-4 steps of stairs (Figure 18). It was observed that the entrances of some buildings were below street level (Figure 19). To reach the entrances of these buildings, pavements were used and a gap was created, therefore the pavements lost their function. This situation interrupts the relations of the buildings with the street and pedestrian circulation.

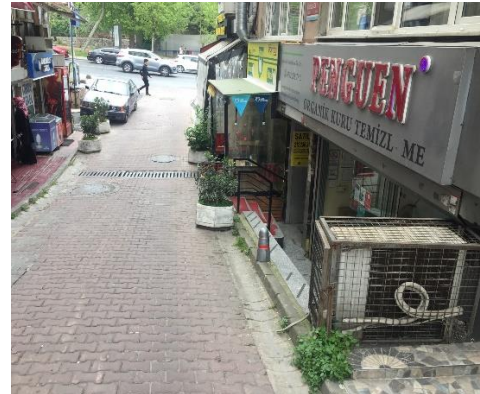


Figure 18- 19. Buildings with Different entrance levels on Ressam Hamdi Bey Street (from the author's camera)

When the buildings in the region are examined, it is observed that almost all of them are adjacent. Some buildings have blind facades and high garden walls. If the transparency rate on the facades of adjacent buildings is not sufficient and the blind facades face the already narrow streets, they form an uninterrupted wall form on the streets (Figure 20, 21). These buildings cause the streets not to receive enough daylight due to the buildings, create a perception of insecurity for the users, and negatively affect the public nature of the streets. In this observed situation, it can be said that the surroundings of the buildings were not considered during the construction and design phase and the building-street interaction remained weak.



Figure 20. High garden wall and windowless facade on Selamlık Street (from the author's camera)

Figure 21. High garden wall on Abbasağa Cami Street (from the author's camera)

In the past, the buildings on the street were single-story and mostly two-story buildings built of wood and masonry. For this reason, they do not cause major problems in terms of building-

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street relations in narrow streets. However, in the current situation, buildings built in reinforced concrete systems have very different dimensions such as 3 floors, 6 floors, and 8 floors (Figure 22). Although the excessive increase in gauge does not cause any discomfort in terms of its relationship with the wide Beşiktaş Street, as it does in narrow streets, the fact that the buildings do not have an order in terms of gauge, obstructing daylight in narrow streets, the formation of high, uninterrupted walls in the streets and the size-mass relationship reveals a problematic situation.



Figure 22. High-storey reinforced concrete buildings on the Beşiktaş Street (Google Maps)

Examination of Bebek Neighborhood in the Context of Building-Street Relationship

Bebek is a neighborhood of the Beşiktaş district, with Aşiyan neighborhood in the north and Arnavutköy neighborhood in the south. After the conquest, the janissary chief, Bölükbaşı Bebek Çelebi, who was responsible for ensuring public order during the construction of Rumeli Hisarı, had a mansion and garden built for himself in Bebek, the settlement next to Rumelihisarı, and it is known that after Çelebi's death, the settlement was called Bebek (Küçük, 2021). In the 16th and 17th centuries, settlement was encouraged in the Bosphorus, and a slow but regular population increase occurred over time. Although Turkish neighborhoods were established in some Bosphorus villages such as İstinye, Üsküdar, and Yeniköy in the 16th century, there are mostly Greek settlements in Bebek and the Turkish neighborhood in the district was established in the 18th century.

The district was opened to construction in this century and was equipped with various structures such as mosques and masjids. Following this, the land belonging to the state on the coast and on the land side, up to the Kayalar location on the Küçük Bebek side, was parceled out and sold to the public. Within a few months, a new Boğaz village/neighborhood was established here and this village was called Hümayun-âbâd. Besides, the name Bebek continued to be used (Koçu, 1961). This formation is parallel to the neighborhood establishment of the Ottoman period. Starting from the 1950s, as a result of the policies of the period, migration to Istanbul increased and squatter settlements began to appear. High-rise apartment buildings, vehicle scale and wide streets, which were the urban perception of Istanbul between 1950 and 1960, began to be accepted in Bebek over time. High-rise buildings built from reinforced concrete between 1960 and 1965 began to appear throughout the region. As of the beginning of the 21st century, construction activities continued (Küçük, 2021). In the study, the part shown on the map below for the Bebek neighborhood was examined, observations were made on this region and suggestions were given (Figure 23).



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Figure 23. Studied area for Bebek Neighborhood (Snazzy Maps)

When the facades of the buildings in the Bebek neighborhood were examined in the context of their relationship with the street, buildings with wider and more transparent facades were found on Cevdet Paşa Street compared to the other two areas discussed in the study. In addition to having wide and highly transparent facades, these buildings have large front gardens, which ensures that users have a positive street perception, that the buildings establish a non-intrusive relationship with the streets, and that the streets receive sufficient daylight (Figure 24, figure 25). In addition to the presence of large buildings with high transparency in the region, buildings with blind facades, few windows, and low transparency were also seen, especially on narrow streets. These structures prevent sufficient daylight in the already narrow streets during the day, and at night, due to the lack of artificial lighting, they increase the perception of insecurity and cause the buildings to have a negative impact on the streets. Such structures were seen on Bebek Bostanı Street. (Figure 26).



Figure 24, 25. Buildings with wide facades on Cevdet Paşa Street (Google Maps)

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Figure 26. Low transparency facades on Bebek Bostanı Street (from the author's camera)

Front and back gardens were more common in the Bebek neighborhood compared to the other two areas examined in the study. It has been observed that in some buildings whose entrance level is lower than the street level, the entrance stairs are prevented from interfering with the sidewalks and streets by using front gardens or intermediate spaces. In İnşirah Street and Bebek Yokuşu Street, it is generally seen that the building-street relationship is not direct, but there is a building-garden-street hierarchy (Figure 27, figure 28). In addition, supporting gardens with landscaping, dense green texture, and use of garden fences provide a spacious atmosphere for city residents passing by on the Street (Figure 29, 30).

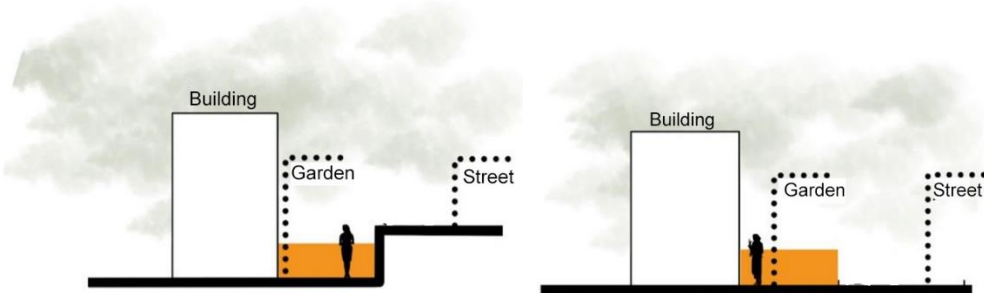


Figure 27, 28. Building-garden-street hierarchy in Bebek (Yıldırım et.al., 2022)



Figure 29, 30. Building-front garden-street hierarchy on İnşirah Street (Google Maps)

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However, it has been observed that the entrance stairs of some buildings that do not have a front garden and whose entrance levels are different from the street level act intrusively on the sidewalks and streets (Figure 31, 32). This situation cuts off pedestrian circulation and shows that the building-street relationship is not taken into account in the design and implementation process.



Figure 31, 32. Buildings whose entrance levels are different from the street level (from the author's camera)

In the area, it is seen that there are commercial and entertainment venues on the main street, that is, Cevdet Paşa Street, as in the Arnavutköy district, and on the ground floors of the buildings located close to this street. These functions create vehicle and pedestrian density in the region and cause sidewalk interference. However, since some of the businesses seen along Cevdet Paşa Street have private areas that do not occupy the sidewalks, there is no interference with the pedestrian axis of these businesses. This is proof that streets, which are urban elements, are taken into consideration in building design and the use of different functions located in the building.



Figure 33. A cafe that does not take intrusive action on the streets (Google Maps)



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Opinions of Users of the Areas and Student Observations

Within the scope of the Beşiktaş Municipality "Keep Your Neighborhood Alive" study, interviews were held with the users of Arnavutköy, Beşiktaş Çarşı and Bebek neighborhoods on 15 April 2022, 22 April 2022 and 2 June 2022 (Figure 34, figure 35). The users who attended the meetings were generally residents of the neighborhood and tradesmen. However, a few local tourists also attended the meetings to express their opinions. As a result, ideas were obtained from different perspectives of different users. In the interviews, users expressed their complaints and requests specific to their regions. Approximately 50 people were interviewed in each region. User requests and needs were noted, and ideas were asked for solutions to the problems.



Figure 34, figure 35. Meetings with the users of Arnavutköy, Beşiktaş Çarşı and Bebek neighborhoods (from the author's camera)

According to the interviews, the complaints and requests of the users of Arnavutköy, Beşiktaş Çarşı and Bebek neighborhoods are given in the table below (Table 1).



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Table 1. Complaints and requests of the users

District	Requests and Complaints
Arnavutköy	<p>"The sidewalks are occupied by shops. For this reason, it is difficult for people to cross the sidewalk."</p> <p>"Cafes should not occupy sidewalks. They should have their private areas and arrangements should be made for this."</p> <p>"We cannot use the streets. We do not want the cafe bar furniture in the streets."</p> <p>"No more businesses should be licensed."</p>
Beşiktaş Çarşı	<p>"We cannot go out because of the cars parked at our door. Our buildings have completely lost their connection with the street."</p> <p>"I am a tradesman, I comply with my occupation limits, but we are having problems with both the tradesmen and the public because other tradesmen exceed these limits and spill into the streets."</p> <p>"Cafe and bar functions do not fit historical buildings in the area."</p> <p>"Many tradesmen do not comply with the rule regarding the limit of the area where they can place their tables and chairs. This needs to be inspected and the limit of table and chair occupation on the sidewalks should be reduced by 50%."</p>
Bebek	<p>"The sidewalks reserved for pedestrians on İnşirah Street are insufficient. The streets need to be organized, the levels should be corrected and the slopes should be used effectively."</p> <p>"The valets in the cafe-bar establishments occupy the sidewalks in the side streets, we cannot walk on the already narrow pavement anymore because of these valets."</p> <p>"Although the shops on the ground floors provide activity in our area, they do not fit into our neighborhood."</p> <p>"I am a tradesman here. I comply with the street occupation limits. Cafes and restaurants have helped revitalize the streets and make Bebek one of the most popular areas of Istanbul."</p>

According to the interviews, almost all residents of the three regions complained about the different functions located on the ground floors, creating vehicle and human congestion and occupying the streets. In addition, the tradesmen did not complain about this situation but complained that other tradesmen placed their items such as tables and chairs in a larger area outside than they did. There appears to be a dilemma here. The ground floor functions of buildings, which is the most talked about topic in the context of the relationship of buildings with the street, are perceived differently by different users. While this situation is negative for the residents of the neighborhood, shopkeepers, and local and foreign tourists do not complain.



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On the contrary, they think that these functions revitalize the regions, emphasize the publicity of the streets, and strengthen the relationships of the buildings with the streets.

In the Keep Beşiktaş Neighborhood Alive Workshop held between 8-22 May 2022, participating students, accompanied by workshop facilitators, made observations in Arnavutköy, Beşiktaş Çarşısı, and Bebek neighborhoods (Figure 36). By sharing the observation results with the managers, they developed solution suggestions and expressed them in the sheets. Student and author observations are similar.



Figure 36. Participating students and site observations (from the author's camera)

According to students, building entrances are decisive in the relationship of buildings with the street. It has been observed that some building entrances can be reached by stairs due to the level differences between the street and the building, but most of these stairs act intrusively on the streets. In all three regions, negative aspects of the functions located on the ground floors were encountered in terms of building-street relationships. It has been observed that tradesmen's courier vehicles and items such as tables and chairs occupy the sidewalks and streets. It has been stated that the gaps formed between the building and the street due to level differences cut off the relationship of the buildings with the street and pose a danger to pedestrians. Also, it has been observed that narrow streets were formed due to the proximity of building blocks and parcels to each other, but today, especially in the Beşiktaş market area, the street typology is in the form of buildings-narrow pavements-vehicles-narrow streets. Although front garden formation and building-front garden-street interaction are generally seen in the Bebek neighborhood, this formation is not seen in the Beşiktaş Çarşısı area and has been observed, rarely, in the Arnavutköy neighborhood. The analysis posters prepared by the students are shown below (Figure 37, Figure 38, Figure 39).



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Figure 37. A poster created by students for Arnautköy (Yıldırım et al., 2022)

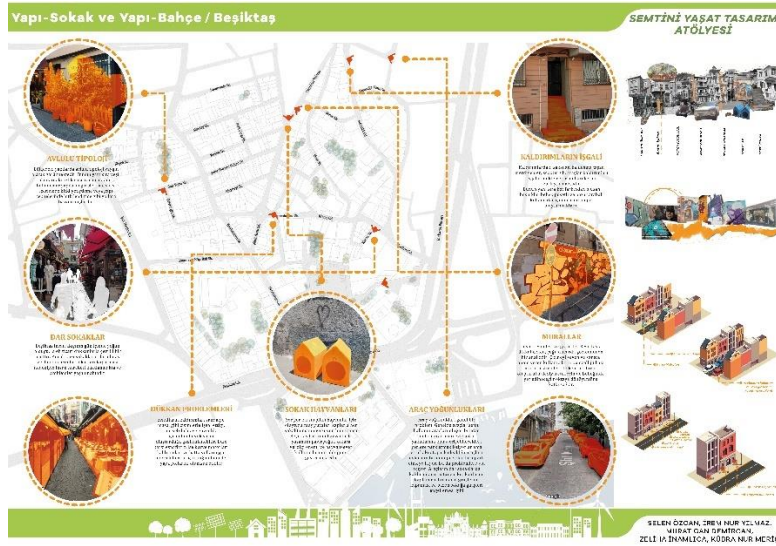


Figure 38. A poster created by students for Beşiktaş Çarşı (Özcan et al., 2022)

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Figure 39. A poster created by students for Bebek (Akkavak et al., 2022)

4.SUGGESTIONS and CONCLUSION

The building-street relationship is one of the important features examined within the scope of urban morphology to create livable cities. Within the scope of this concept, the relationships of building facades, entrances, ground floor functions and gardens with the streets in Arnavutköy, Beşiktaş Çarşı and Bebek regions were examined. Apart from the author's observations, the data obtained as a result of the meeting held in all three regions on different dates and attended by the users of the region and the workshop organized for students were also taken into account.

Although ground floor functions are important for the creation of active streets, these functions cause some problems in all three regions because they are positioned without taking into account the structure of the streets, which are public spaces. In this context, a few suggestions will be given: The usage limit of businesses on the ground floors of buildings on pedestrian paths should be determined, it should be a maximum of 1.5 meters and it should be under supervision. In order to reduce the vehicle density currently caused by ground floor functions, parking should be built in the most suitable area without damaging the historical texture of the region, and vehicle density, especially in narrow streets, should be prevented.

Another problem observed in the context of building-street relationship in the areas is the building entrance stairs. It has been observed that the built environment is not taken into account sufficiently during the application phase of many entrance stairs or the construction of pavements, and the draw distance is not observed in relatively new buildings. These factors cause the intrusive action of entrance stairs on the streets. In order to solve this problem, sidewalks should be made wider (minimum 1 meter) to match the width of the street or the entrance doors of non-historic buildings should be moved back, space should be reserved for stairs outside the sidewalk, and obstruction to the pedestrian axis should be prevented.

In all three regions, it has been observed that some streets create an unsafe perception in people due to the blind facades of the buildings or insufficient transparency rates. However, as explained in the study, building facades are the most important factor in the building-street relationship. To address this problem, building facades (historic and non-listed) that give rise to continuous street walls must be appropriately disrupted by other architectural features,



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including building articulation, setbacks, and potential protrusions in the building envelope. New buildings to be built in the regions should be designed in such a way that the facades and entrances of the buildings will create the perception of a safe, livable and strong public street in people, that is, taking into account the presence of windows and entrance doors on the adjacent streets.

Parcels and building blocks come together to define the streets. The buildings located on the plots make both typological and perceptual definitions of the streets. Although these private and public spaces are different in terms of space hierarchy, they always interact with each other. For this reason, streets should be taken as a reference when designing buildings, and buildings should be taken as a reference when creating streets. Otherwise, it is impossible to create lively buildings and streets for users.

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AN ANALYSIS OF MULTI-SENSORY EXPERIENCE AND ACTIVITY IN STREET

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ABSTRACT

Streets are micro-scale urban outdoor areas encompassing the ground, pedestrian walkways, and roadways and bounded by building facades. They serve as urban circulation zones and foster life. Considering Lefebvre's trialectic within the space production, streets emerge through the interaction of design, perception, and lived experience. This production cycle recurs over time. Movement is a significant factor that influences street users. During the experience, all sensory organs simultaneously contribute to perception. As the human body navigates across physical space, the eye dynamically shifts its focus toward different perspectives. This study aims to evaluate user experiences and activities within urban streets' perceived and lived spatial context. User experience encompasses diverse sensory aspects, encompassing visual, auditory, olfactory, gustatory, and tactile encounters, all contributing to a multi-sensory perceptual interaction. Initially, an in-depth review of the literature was undertaken. Taxonomies, variables, and classifications were identified. Subsequently, a comprehensive model was formulated. We chose Mevlâna Street, one of the main backbones of Konya, as the case. We divided the street into thirty-two equal parts on the plan. In this context, the street encompasses diverse sensory stimuli, including auditory, olfactory, gustatory, and tactile sensations. The variety of activities on the street could be increased for highly sensually rich streets.

Keywords: Activity, Experience, Multi-Sensory, Street.

1. INTRODUCTION

The human mind constructs reality through experience. The construction process consists of the sensory perception and mental processing of reality. According to the literature on experience, researchers and philosophers attempt to define and comprehend experience from various perspectives. Perception is an element of experience (Merleau-Ponty, 1962, p. 4). The experience of a visual field does not comprise limited data. Numerous variables from the past and future, as well as human emotions such as hope, desire, and wish, round out the experience. Furthermore, light makes visual experience conceivable. Merleau-Ponty (1962, p. 4) describes seeing and hearing as unadulterated experiences. The experience must be brought to consciousness and processed by the brain. However, there are certain filters that intellect employs. Reality and the experience of reality are distinct (de la Fuente Suárez, 2013). There are habits, preconceptions, concepts, individuals, and knowledge in every experience



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(Oakeshott, 2002, p. 14). Oakeshott (2002) identified sensation, perception, intuition, judgment, emotion, and thought as the fundamental characteristics of experience.

This study aims to investigate the perception of space on city streets. What factors influence the perception of pedestrian space? What coding methodologies do these variables employ? How do variables influence the perception of space? Simultaneously, a table was constructed to depict the experience of space visually. The "0" and "1" system is an experiment to demonstrate the experience. Senses are the origin of experience variables. Therefore, visual, auditory, and olfactory experiences are included. Tasting is excluded because it is subjective, and the experience of space is realized in specific locations, including activity variables. Mevlana Street was selected for the case study.

2. Experience of Streets

Experience originates from cognitive processes and has an abstract nature. In Holl's (2006) analysis, geometry, action, and sensation are distinct components of the overall experience. Pallasmaa (2006) focuses on the role of the senses in shaping the architectural encounter, emphasizing the interconnectedness of sight, taste, hearing, touch, smell, and movement. During the Renaissance, a hierarchical method was used to analyze human sensory perception. The sense of sight was often linked to fire, water, and light, while hearing was related to air. The smell was often connected to steam, taste to water, and touch to the earth as an element. In summary, the senses were believed to have associations with the cosmic body (Pallasmaa, 2006).

According to Merleau-Ponty (1996), the eye, as a self-moving instrument, excites the world and returns it to visible via imprints. Furthermore, Merleau-Ponty (1996) highlights visual experience. Merleau-Ponty (1996) relates the body to the notions of horizon, dimension, dimensionality, thickness, depth, space, and spatiality. Seeing enables us to experience various perspectives in space through the movement of the body and eye. Other sense organs and movements realize the spatial experience to be complete. Merleau-Ponty (1996) asserts that all experiences entail memory, recall, and comparison. In this context, it serves as a form of memory.

Although perception is processed in the brain, it is interpreted using information such as culture, history, education, feelings, and personality traits. Perception and interpretation give rise to our specific experiences. In Figure 1, Tuan (2001) explains the connection between experience, sensation, emotion, and thought. Sensation, perception, and comprehension comprise human experience, and during this experience, sensations increase from perception to sensation, and concepts increase from sensation to perception. According to Tuan (2001) kinesthesia, visual experience, and tactile experience are the concepts that give humans strong feelings about experience and spatial quality.

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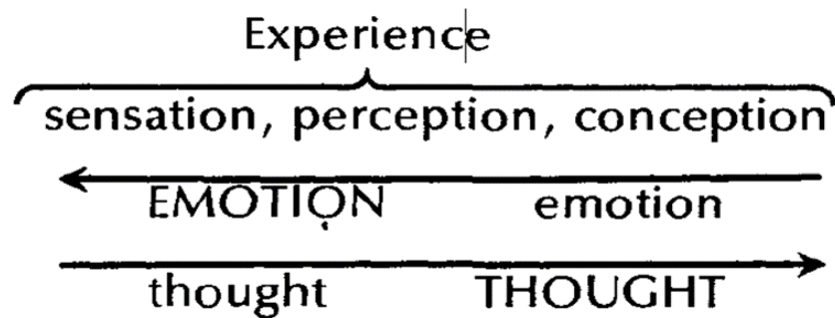


Figure 1. Experience, emotion, thought Tuan (2001, p. 8)

Lentini and Descartes's (2010) criteria for psychological experience are summarized below.

- Geometric and geographical experience is the experience of the physical elements of the environment, such as distance, structure, form, and position of different elements that make up the space.
- Sensory experience is the sensory experience of the environment, such as color, smell, material, and texture.
- Cultural experience includes behavioral appropriateness, understanding cultural expectations and behaviors, and the consequences of hoped-for and accepted behaviors.

The other two types of experiences, apart from physical, sensory, and cultural characteristics, were associated with the meaning of the space experience. Two types of experience are below:

- Personal experience is an individual experience of space that includes meaning.
- Relational experience involves experiencing the communication possibilities that occur in space.

Geometric, geographical, sensory, cultural, personal, and relational experiences diversify the experience of space, but in reality, the experience of space encompasses them all. Gifford (1983) utilizes personal experience of space to examine interpersonal distance during communication. Perdikogianni (2007) discusses the role of experience in place formation through urban and neighborhood relations. Stavrides (2006) relates the concept of heterotopia to the experience of place. He examines the spatial boundaries of people called others and the processes of becoming compatible/discordant with space. The experience of space continues wherever there is space, in cities, streets, and parks, where human beings complete the sense of space by creating boundaries to the void.

According to Cullen (1961), when buildings are considered to come together as a group, it is seen that the space between them has a life beyond itself and the buildings that make it up. In this context, the environment realizes a sensory reaction. This reaction is manifested in three ways:

- Regarding optics, the act of walking in urban areas produces a variety of visual perspectives. The design aims to develop urban elements that captivate the senses through sequential visual experiences. A lengthy and unvarying road creates a monotonous impact due to the consecutive occurrence of identical elements. Cullen (1961) states that the human mind operates based on



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contrasts. When there are variations in forms, the impact of sequential perception becomes apparent. Another consequence of serial vision is the attainment of cohesion within urban environments. According to Cullen (1961), the current perspective or perception of the urban environment and the revised perspective transforms the city into a compelling theatrical production.

- Regarding space: How our body senses and reacts to the environment is connected to its position. Upon entering a room, the user subtly conveys the notion of being both outside and inside simultaneously while also acknowledging their presence within the space. In this context, the physical form aligns itself with the concept of space, perceiving it as a dichotomy of "here" and "there." As per Cullen's research in 1961, this sensation is associated with being on the street or in a public square.

- Regarding content: Content is associated with concepts such as color, texture, scale, style, character, and the distinctiveness in shaping a space. When an individual strolls along a street, they observe the coexistence or layering of various architectural styles. When an individual strolls along an unfamiliar street, the individual may observe straight pathways and consistent architectural designs. Cullen (1961) expresses criticism towards similarity. In this context, the presence of content leads to the distinction of urban space. This piece is titled "This and That" and was composed by Cullen in 1961. He eloquently characterizes streets as an urban expanse, carefully selecting his words to convey their essence.

- Engaging in motion: A common human behavior observed on the streets. When individuals come to a halt, their next instinct is to contemplate their next movement. Cullen (1961) suggests a thoughtfully planned pedestrian movement in urban areas akin to the well-organized pedestrian movement within a church. The perception of user movement on the street should be carefully designed from beginning to end.

- Fluidity resistance: Fluidity resistance is encountered in spaces where static and dynamic movements coexist. This term also describes the combination of interior and exterior space.

- Closure: It represents the opening of the interior to the exterior. It is also the complete closure of the envelopment.

- Envelopment: Envelopment involves the envelopment of the walking body or the body in a motor vehicle moving on wheels with the forms around it. In the continuous facades, the movement is held in tension by the rectangular structure that blocks the exit. Furthermore, a momentary balance is established between pure fluidity and envelopment.

-Thereness: When considering the connection between the road and the mountain, it can be observed that the mountain consistently maintains its presence concerning the road. This observation also applies to the streets. On streets that begin and conclude with a square and proceed in a straight line, the square plays a role in walking, sitting, and remaining stationary.

- Level change: Spaces with low ceilings create an enclosed feeling. Spaces that possess greater height evoke a feeling of authority and dominance. As per Cullen's (1961) findings, descending and ascending denote acquiring knowledge, while ascending signifies the path towards the unfamiliar.

- Constriction: These areas denote the convergence of buildings, resulting in narrower spaces between them. It is crucial to regulate the movement of pedestrians in such areas.

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- Revised: The various levels of space that the residents of a town navigate directly influence their senses, and as stated by Cullen (1961), grid plans are thus regarded as conflicting with human nature.

- Appropriateness: This concept relies on the essential aspect of maintaining mutual respect among community members. As per Cullen's (1961) findings, propriety and etiquette are not synonymous. As an illustration, a humble street is adorned with a metallic sign of a shop. While it may not be deemed conventional, it is suitable if this establishment is a metalworking enterprise.

Sheller (2014) discusses kinesthetic experience and how it influences our perception of time space, and ability to adapt to the world. According to Sheller, our kinesthetic sense of body movement is crucial in understanding and interacting with the surrounding environment. According to Sheller (2014) space is generated by the rhythm and friction of the movement flow. The pedestrian is actively participating by moving towards the center of the room. As depicted in Figure 2, the urban setting is meticulously crafted by architects and urban designers, placing significant importance on visual aspects. However, urban livability encompasses more than just visual appeal. It encompasses the overall experience of the street, with various perspectives, sounds, smells, textures, and tastes.

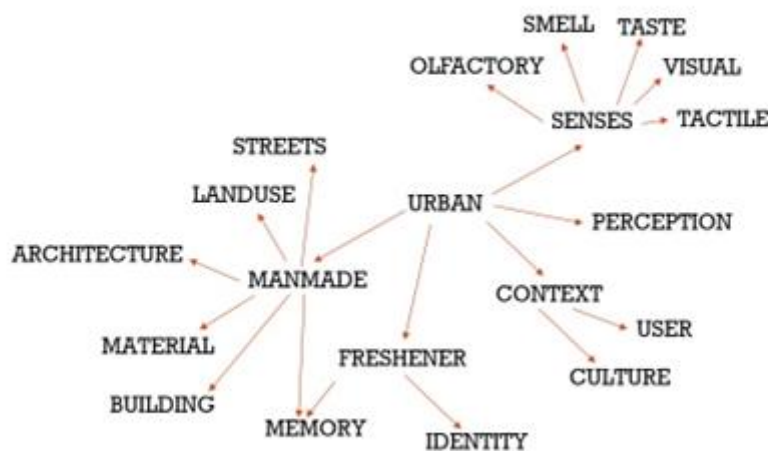


Figure 2. Experience in urban (Temple, 2013)

Visual Experience: The visual experience is a significant way we perceive the street. Numerous factors can influence the experience of perceiving objects in physical space. The human eye can perceive various aspects, such as distance, light changes, and color alterations (Porteous, 1996). According to certain researchers, there is a prevailing characteristic associated with the eye. For instance, Porteous (1996) asserts that in Western cultures, the eye tends to be more dynamic and perceptive than other senses. Pallasmaa, in his book (2011) "Eyes of the Skin," explores this matter and asserts that the sense of touch is equally significant as vision.

When we analyze the attributes of the visual experience, we observe that the sensory organ involved is the eye, the data received is in the form of light, the mode of transmission is also light, the activity of the sensory organ can be described as opening and closing of the eye, the



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environment's activity is perceived from a particular perspective, the type of action involved is deliberate and controlled, and the perception of depth and direction is achieved through linear perspective. The visual aspects of urban spaces include color, shape, size, volume, density, visual complexity, visual harmony, imaginability, subjectivity, and compatibility with nature (Naghizade & Ostadi, 2014a).

Auditory Experience: As one walks along a lively street, many sounds emanate from various sources, creating a rich auditory experience. Examples of sounds heard on the street include the honking of horns, the sound of people's footsteps, the noises of motor vehicles, and the voices of humans. In contrast to the visual experience, the auditory experience generates spaces that lack distinct boundaries. In this context, the experience of sound is more dynamic than the experience of sight, and it is an experience that cannot be easily concentrated on (Porteous, 1996). Auditory experience encompasses the connection between the sensory environment and one's actions (Diaconu, 2011) and the process of acoustic communication (Truax, 1984) The auditory stimuli that we perceive while walking along a thoroughfare can be categorized into distinct groups, namely human sounds, natural sounds, musical sounds, transportation sounds, and mechanical sounds.

Human sounds can be classified into various categories: walking, running, speaking, laughter, baby crying, and children's voices. Nature can be categorized into various components: sound, plants, animals, and natural elements. Examples of sounds include barking, rustling leaves, thunder, and waves. Music sounds can be categorized into two main types: those created by live instruments and those produced by technical equipment like television and radio. Indoor sounds are categorized as sounds originating from residential dwellings, workplaces, and places of worship. These sounds include the noise produced by showers, toilets being flushed, computers running, and bells ringing. Transportation sounds are the sounds that come from roads, railways, and airlines. These examples include a helicopter, an airplane, a train, and a motor car. Sounds also vary across various streets, each contributing to distinct cultural frameworks. In areas where Christian societies reside, bells can be heard resonating through the streets. Conversely, the call to prayer reverberates through the streets in areas where Muslim societies reside.

When we analyze the qualities of auditory perception, we observe that the ear serves as the sensory organ, and the information received is in the form of sound. The sensory organ becomes activated by auditory receptors. The features of urban space that are perceived through sound include depth, distance, space, and fullness. The characteristics of wall coverings, social communication, traffic, vitality, security, the sound of nature, and vibration are also observed (Naghizade & Ostadi, 2014a)

Olfactory Experience: According to Porteous (1996), smell contains less information and more emotion than sound, environmentally. The olfactory space is an unstructured, overlaid, uncontrolled space. The world of smell is dispersed, incomplete, transient, and sensory (Porteous, 1996). When we move on any street, we feel surrounded by odors. The smell of food, the smell of fresh grass, the smell of flowers, the smell of spices, as well as different odors are encountered on the streets. Toposmia is a term used to make sense of odors' location and relationship with space (Drobnick, 2010) Drobnick (2002) says that olfactory environments are fragrant and picturesque. If we examine the characteristics of the olfactory experience, it is seen that the sense organ is the ear, the received data is odor, and the transfer type is air. Smell



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receptors activate the sense organ. The universe is the entire field of smell. It is seen that the features of urban space experienced with odor are the presence of natural elements, cleanliness, air pollution, sense of memory and space, and spatial continuity (Naghizade & Ostadi, 2014).

Taste Experience: Food is one of the fundamental necessities for human beings. Additionally, it is one of the factors contributing to the utilization of the street, and the taste experience is pleasurable for the individual. In urban areas, relying on a restaurant or café name to obtain directions is common practice. The location is associated with the sensation of taste. The taste experience in urban space is also associated with our memories. The ice cream we consume while walking along the street and the bagel shop at the street corner assist us in recognizing the specific location. Simultaneously, the duration we allocate to consuming meals outdoors enables us to divert our attention toward additional environmental characteristics on the street (Naghizade & Ostadi, 2014).

The assessment and charting of the culinary encounters in public areas are conducted by sampling the menus offered at various café and restaurant establishments situated along the streets. When we analyze the characteristics of the taste experience, we observe that the sensory organs involved are the tongue and mouth. The data received during this experience includes taste and aroma; the transfer mode is through the mouth. Taste receptors activate the sense organ. Subjectivity is inherent and manifests through action. According to Naghizade and Ostadi (2014), it is imperative to prioritize the aspect of taste. The measurement of taste experience is not included as a variable.

Perceptual system	Sensory organs (receptors)	Receivable information	Transfer type	Affectivity of sensory member	Affectivity of environment	Scope	Action type	Depth and direction of space perception	Perceiving qualities of urban space
Visual	pupil	Light, glittering of color	Media (light)	Open and close pupil	Perspective definition	General	Controlled action	Directional view	Color and form, volume and size, diversity, visual richness, visual coordination, imaginability, visual personality, consistency with nature
Auditory	External and internal ear	Sound (type, direction, distance, source, speech)	Media (sound)	Stimulating hearing receptors	Echo	Public	Reaction	All directional hearing	Depth and distance, full and empty, quality of wall covering, social interaction, rush hour and traffic, vitality, security, sounds and names, natural environment sound, vibration, immediately
Olfactory	Smelling cavity	Smell direction	Media (air)	Nose mucus stimulation	Smelling field definition	Semi-public	Reaction	All directional taste	The presence of natural elements, freshness, environmental pollution and cleanliness, memory and sense of place, spatial continuity
Gustatory	Tongue surface and mouth cavity	Taste and flavor	Media (mucus)	Stimulation of taste buds	-	Personal	Action	Concentrated tasting	Space taste, anchor points, identification of mental reference points
Tactile	The skin of all body surface	Temperature, humidity, tissue quality pressure, pain, tenderness, rapidness, intensity speed	Direct	Deformation, color change and skin tissue, physical and chemical changes of skin	Presence, objects transferring	Fully personal	Action and reaction	All directional access	Environment temperature and humidity, wall material, total volume depth of the element and details, passage of time, belonging feeling, important role, history and the past, restriction, surface flexibility, public arts, durability and stability, continuity of motion, hierarchy, climatic comfort, fourth dimension perception

Figure 3. Five senses (Naghizade & Ostadi, 2014)

Tactile Experience: Unlike other sensations, the tactile experience necessitates a more intimate connection with the urban environment. The ground beneath our feet as we walk along any street, the handrail we hold onto when going up or downstairs, and the urban seating areas are physical elements of the city that we can feel through touch. Psychologists have defined tactile experience as encompassing sensations such as warmth, pain, and pressure. Additionally, they

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provide valuable insights regarding objects' shape and surface characteristics (Diaconu, 2011). Furthermore, it is linked to sensations such as itchiness and tingling and various types of stimuli, including mechanical, chemical, and thermal factors (Naghizade & Ostadi, 2014). Naghizade and Ostadi (2014) classify tactile experiences into four categories based on their type and characteristics. The adjectives used are hot/cold, wet/dry, soft/hard, and smooth/rough.

Figure 3 analyzes the attributes of the five sensory encounters. While visual experiences exhibit general characteristics, auditory experiences occur within specific boundaries. Hence, it exhibits traits that are observable to the public. The sense of smell exhibits certain qualities that can be considered public. The olfactory experience comprises the odor's presence and the individual's subjective perception. Gehl and Svarre (2013) identified walking, standing and sitting as optional activities (Figure 4).

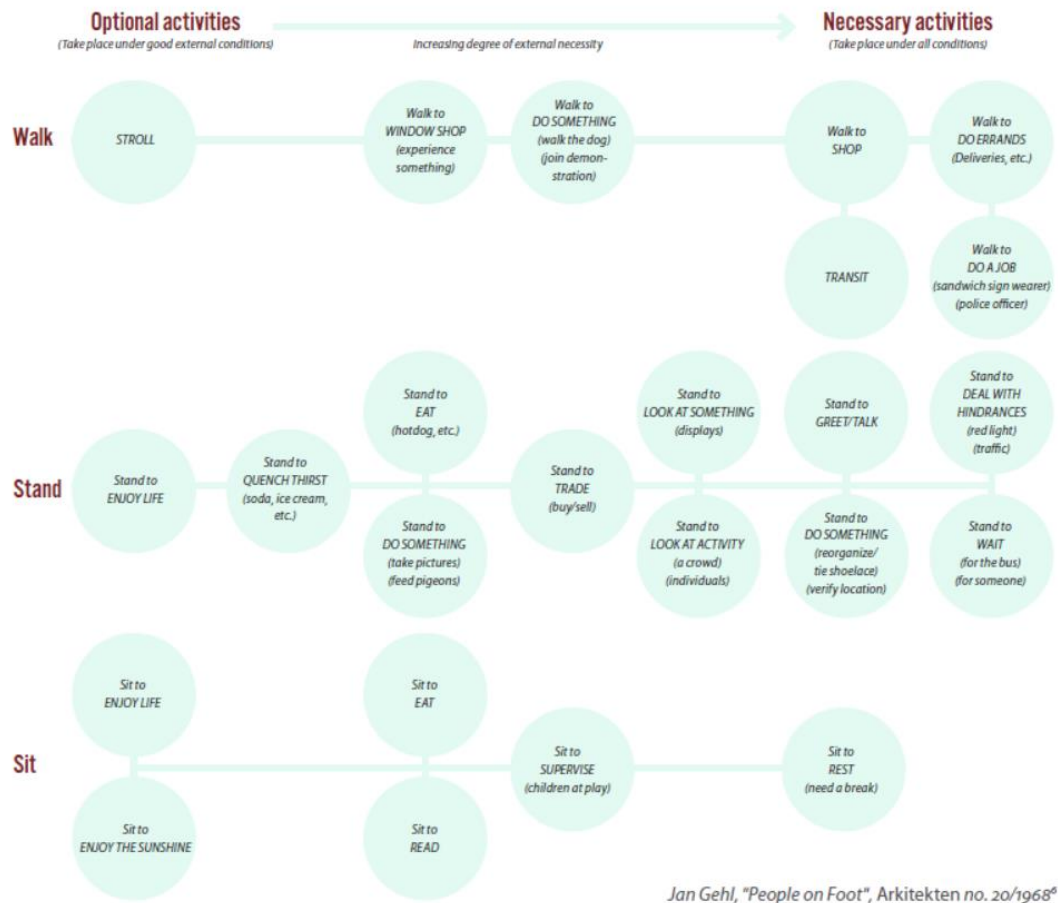


Figure 4. Activity requirements table (Gehl & Svarre, 2013).

3. MATERIALS and METHODS

This study aims to analyze the perception of spatial elements in urban environments. Firstly, articles, papers, and books about street experience were thoroughly examined. The sensory information received shaped the user's initial experience of the street. The scope encompasses visual, auditory, olfactory, and tactile experiences. Walking is an essential activity for fully



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immersing oneself in the street environment. We walked through the street. Mevlana Street is a prominent thoroughfare in Konya, a moderately sized city in Turkey. The street holds great historical importance due to the tomb of Mevlana Celaleddin Rumi, a philosopher from Anatolia, and the tomb square along this street. The street was divided into sixteen sections, stretching from Alaaddin Hill to the Mevlana Tomb and vice versa, from the Mevlana Tomb to Alaaddin Hill. An equilibrium was noted in the distribution of roads, buildings, and the proximity of walking distances among the different areas. Video recordings were captured during the walk using a "Goprohero Black 5" camera at a 1.65 cm height corresponding to eye level. These recordings were then documented. The sensory experience was categorized using binary code, with 1 representing the presence and 0 representing the absence of various elements such as nature, music, humans, machinery, transportation, smells related to nature, food, garbage, emissions, synthetic scents, and industrial odors. The 16 spatial cross-sections were sequentially recorded to form an architectural depiction of the fundamental encounter of walking along the street. This study aims to initiate a discussion about the experience of space in creating space rather than seeking to establish absolute and unchanging knowledge.

4. FINDINGS and DISCUSSION

Mevlâna Street is located on the transportation axis between Alaâdin Hill and Mevlâna Türbeönü Square in Konya. When the historical process is analyzed, it is one of the important streets and the main backbone of the city. Many buildings and places of worship are on it, which functions with administration and trade. Historical monuments such as İplikci Mosque, Şerafeddin Mosque, and Konya Governorship Building are also on the street. When local government policies are analyzed, it is seen that Mevlâna Street has been planned with a focus on walking and cycling.

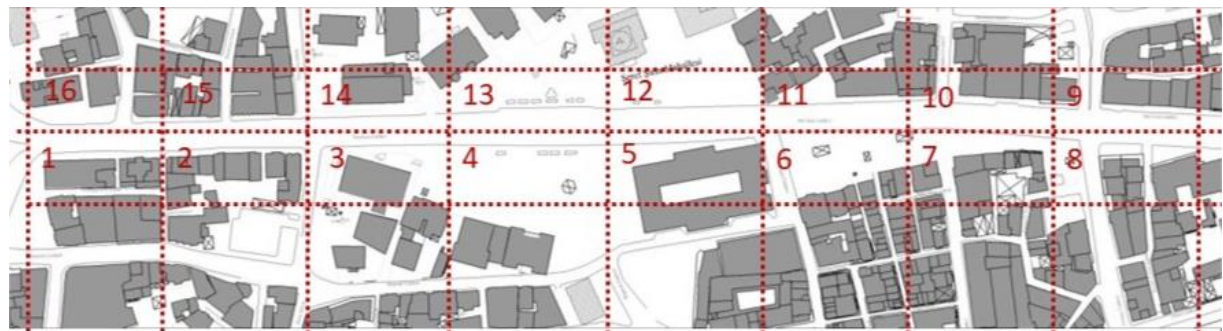


Figure 4. Space Sections on Mevlana Streets

4.1 Visual Experience

Space 1 is located along the route from Alaâdin Hill to Mevlâna Türbeönü Square. The İş Bankası and Tekel Building can be found in this area.

The sidewalk has a width of 4.85 meters. There is a noticeable variation in the heights of buildings in this area. There are a total of eight trees. Simultaneously, six obstacles are identified. The obstacles include electrical panels and lighting fixtures needing to be properly aligned along the street. In this area, designated guide tracks are intended for individuals with disabilities. Despite the absence of designated seating areas, visitors use the stairs within the İş Bank building and the water basins on its facades as alternative seating options. Additionally,



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electricity panels are utilized as a designated stopping area. In this place, it is observed that children are seated and engaging in begging during the evening hours.

Space 2 is typically the area where the commercial function is concentrated. The variation in the width of the pavement remains consistent. A total of eleven trees and seven obstacles were detected. The height of buildings varies. Within this area, guide markers are specifically intended for individuals with disabilities. The recesses on the building's facade, which are flooded during periods of heavy rain, serve as seating areas for the building's occupants. The merchandise being delivered to the stores is also left on the street.



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Table 1. Space Sections and Photographs

	1		8		15
	2		9		16
	3		10		
	4		11		
	5		12		
	6		13		
	7		14		



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Space 3 is the location of the İplikçi Mosque on Mevlâna Street. The mosque is a setback, forming a sidewalk wider. There is an elevation difference where the mosque intersects with the sidewalk. The mosque parapets are used as seating areas. Building height movement is constant. Nine trees and three obstacles are identified. The obstacles are electrical panels and pontoons where the street crosses the sidewalk. The user walks quickly in this section. The user proceeds at a rapid pace. The staircase leading to the mosque serves as a designated area for bicycle parking.

In **space 4**, facades are positioned beyond the street border, creating a spatial configuration encompassing an urban park. There are forty trees along the specified path. The rubbish bin and the lighting element pose barriers along the path of space 4. Pontoons are present on the sidewalk. The park has a decorative pool.

Space 5 is located on the facade of the Governor's Mansion. The width of the elevation is variable. Building height is constant. There are five trees in Space 5. There are no urban elements that would be an obstacle. At the beginning of the route, Ulvi Sultan Tomb and Masjid Restoration work is being carried out.

In **space 6**, the facades are set back, which creates a city square. In the square, an entrance leads down to the underground market of Sarraflars. Seating areas and urban furniture are in this space section. No trees were identified in this section. Five pieces of urban equipment create obstacles at the space entrance, including pontoons, lighting elements, and billboards. The sidewalk route is used as a minibus stop. It has been determined that users use urban elements with different functions as seating areas. The user feels sound with the decorative pool.

In **Space 7**, the facades are positioned further back, thereby expanding the width of the sidewalk. The height of buildings can vary. A total of one tree and six obstacles were detected. It is determined that pontoons, billboards, and electric panels pose obstacles along the space route. A commercial establishment that sells date ice cream is identified in this space section.

Space 8 is home to a variety of souvenir shops and restaurants. The width of the pavement is not consistent. In this particular section of the street, there are two trees. The electric panels are positioned to obstruct pedestrians along the street. The height of buildings can vary. The scent of food is particularly noticeable in the area where the restaurants and bars are situated.

In **Space 9**, The pavement's width variation remains consistent throughout this section. There are nine trees. The positioning of the electrical panel obstructs pedestrians. The height of buildings can vary.

In **Space 10**, the width of the sidewalk movement is constant. There are two trees. Four urban reinforcements that will create obstacles are detected. Building height is constant. Pedestrians walk on the street by changing their routes.

In **Space 11**, The width of the pavement exhibits variability. There are two trees. No urban amenities or infrastructure would provide obstacles to pedestrian movement. The height of buildings exhibits variability.

In **space 12**, the sidewalk widens to form a square. Users fed pigeons in the middle of the square. At the entrance of space 12, the electricity pole and the electricity panel are placed in such a way as to create an obstacle for pedestrians.



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Space 13 is where the facades of the "School of Industry" and "Central Bank" buildings are located. The width of the sidewalk is wide. There is no urban equipment in the urban space that would be an obstacle for pedestrians. Therefore, sitting and standing users are encountered.

Space 14 is the section of Mevlâna Street where the Industrial School and the Central Bank are located. The Central Bank is planted backward, creating a green zone between the sidewalk and the building. There are 30 trees in this space. The width of the sidewalk is constant. The building height movement is constant, and there are no obstacles that would make user movement difficult.

In *Space 15*, there are trade and banks. The width of the elevation is constant. Building height movement is constant. Eight trees and five obstacles are parts of the street. Food odor is detected in this section in the morning, afternoon, and evening. Shopkeepers put on stools in the morning and night and use the sidewalk as a seating area. The guide tracks designed for people with disabilities continue until the end of the space and end with the end of the space. People were eating and standing up.

In *space 16*, the change in the width of the sidewalk is constant. However, the elevation is back 10 meters to form a small square. Building height movement is constant. One tree obstacle is detected.

4.2.Sensory Experience

When the sensory variables determined in the taxonomy from Mevlana Street are examined, the space sections have different variables. When the auditory experience variables are examined, it shows that the sound of nature is felt in certain parts of the street. The fact that the perimeter of the rocky park is parallel to the street allows this sound to be heard. Music sounds usually come from the gift shops on the street. People are only present in each section. No mechanical sound is detected on the street. Transportation is heard in every part of the street except the sixth section. Since the bus stops are in this area, no sound is felt during walking. When the odor experience variables are analyzed, it is observed that there are different odors on the street. The smell of nature is present in a specific part of the street, especially where the sound of nature is felt. Although the smell of garbage is not felt, the smell of emission is felt intensely due to the traffic on the street. Synthetic cleaning and industrial odors are not detected on the street (Table 2).



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Table 2. Sensory experience

Section	Sound					Olfactory						
	Nature	Music	Human	Mechanical	Transportation	Nature	Food	Garbage	Emission	Synthetic	Cleaning	Industrial
1	0	0	1	0	1	0	0	0	1	0	0	0
2	0	0	1	0	1	0	0	0	1	0	0	0
3	1	0	1	0	1	0	0	0	1	0	1	0
4	1	0	1	0	1	1	0	0	1	0	0	0
5	0	0	1	0	1	0	0	0	1	0	0	0
6	0	0	1	0	0	0	0	0	1	0	0	0
7	0	1	1	0	1	0	0	0	1	0	0	0
8	0	1	1	0	1	0	1	0	1	0	0	0
9	0	0	1	0	1	1	0	0	1	0	0	0
10	0	0	1	0	1	0	1	0	1	0	0	0
11	0	0	1	0	1	0	0	0	1	0	0	0
12	1	0	1	0	1	1	0	0	1	0	0	0
13	1	0	1	0	1	1	0	0	1	0	0	0
14	1	0	1	0	1	1	0	0	1	0	0	0
15	0	1	1	0	1	0	1	0	1	0	0	0
16	0	0	1	0	1	0	1	0	1	0	0	0

5. CONCLUSION and RECOMMENDATIONS

The results are summarized below.

* The street has different visual experience characteristics. Buildings are set back, and public spaces are formed on the street.

* There is a green texture on the street.

* There is intense vehicle noise and emission odor due to traffic.

* There is no garbage odor.

* Taxonomies were evaluated in general and not divided into sub-headings. Visual experience elements and sensory experience elements have been documented as part of the experience of the space on the street. However, there are different and complex variables for determining the experience of space. Therefore, definite, and unchangeable conclusions cannot be reached. In this context, experience is subjective. Time can significantly differentiate these variables. For this reason, every person at every moment and different forms of movement on the street constitute different experiences of space and subjective production of space.



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For this reason, walking variables on Mevlana Street between 10:00-10:20 on 8.08.2018 belong only to the researcher and that moment. However, generalizations can be made when the number of people and time is increased.

Thanks, and Information Note

This paper is part of a Ph.D. dissertation entitled "Investigation of Movement Experience in Streets," prepared by Özlem Demirkan under the supervision of Prof. Dr. Kerim Çınar in KTO Karatay University Graduate School of Natural and Applied Sciences, Department of Architecture.

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**UTILIZING GAMIFICATION STRATEGIES AS A PEDAGOGICAL FRAMEWORK
FOR ARCHITECTURAL DESIGN STUDIO**

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ABSTRACT

Technological advancements have enabled combining design education with innovative learning tools. The concept of gamification and game design principles has recently gained significant traction across various domains. Their efficacy in engagingly imparting complex and interdisciplinary skills has been well-established. Professionals in the field suggest that integrating game design principles and gamification techniques into existing educational programs can yield noteworthy benefits, including creating valuable resources that enhance the grasp, involvement, and expertise of challenging technological proficiencies, particularly for novices in the field. This paper aims to review and analyze research that focuses on implementing gamification in education. The study will specifically examine various case studies that have been chosen based on their integration of game design and the feasibility of gamification in educational settings. By conducting this thorough analysis, the paper proposes a gamification framework that can be applied to architectural education within the design studio context. The framework will define and illustrate how gamification and rule-based design methodologies can facilitate knowledge acquisition and enhance deep learning in architectural design compared to conventional design studio pedagogy.

Keywords: Design Education, Gamification, Game-Based Learning.

1. INTRODUCTION

The design studio plays a vital role in undergraduate architecture education, serving as a core component of the curriculum. Its framework and material promote interactive learning, peer teamwork, and self-reliance. A designated physical space, the studio provides students with a platform to articulate and exchange creative concepts and works. Moreover, online learning platforms utilizing gamification techniques offer personalized pedagogical methods in design and architecture education. Students can benefit from a flexible and adaptable learning model by leveraging these digital resources.

As the COVID-19 pandemic emerged, transitioning to distance and online education has brought about complex reactions, particularly in design disciplines like architecture. (2020a; 2020b)The physical nature of design and studio-based education makes it challenging to adjust to the restrictions and limitations imposed by the pandemic. The absence of physical interactions and activities in the studio environment has negatively impacted teachers and learners, eliminating the unique possibilities only available in a studio setting (Brown, 2020).



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Architectural education, in particular, is known for its resistance to pedagogical change. However, urgent action had to be taken, and the first step was to switch to "distance education." Despite this, the learning experience produced by the studio cannot be easily replicated in a digital environment. Therefore, it has become crucial to explore pedagogies suitable for the "digital environment" by examining current approaches to design education in the context of architecture and how learning outcomes are organized.

There were quite complex reactions, especially in design disciplines such as architecture, during the transition to distance and online education that emerged with the COVID-19 pandemic, which has been ongoing since 2020. Design, and especially studio-based education, are activities that take place physically. Restriction/elimination of activities and interactions in the physical environment negatively affects the teacher and learner by eliminating the possibilities created by the studio. In particular, architectural education, one of the disciplines most resistant to pedagogical change, had to first switch to "distance education" as an urgent action. However, considering the learning experience produced by the studio, it has become essential to look for pedagogies suitable for the "digital environment" by examining current approaches to how design education is provided in the context of architecture and how learning outcomes are organized.

A Framework for Design Studio Pedagogy

The differentiation of the design studio from theoretical courses in terms of load and duration is a significant difference that increases the diversity of methods and pedagogical approaches. However, as the creativity and criticality of design studio facilitators increase, facilitators also incorporate radical pedagogical approaches, practices, and activities into their teaching processes. This situation reveals different learning situations and educational approaches that vary from school to school and from person to person. For this reason, the design studio has different characteristics depending on the conditions it operates in and the actors it hosts, and the common point of these characteristics is that they need to be defined (Anthony, 2014) consistently. According to Pendleton-Julian (2010), a design studio is a structure that is open-plan and contains a lot of educational content, which differs from other learning experiences, primarily normative pedagogy models, where formal and informal communication and socialization between all actors continue, not a one-way transfer of information from the teacher to the learner. Meanwhile, a series of learning takes place in which knowledge is assimilated, and skills are built. This learning is a way that meets the program qualifications but is of such complexity that the learner can determine his learning route.

Design studio, with its diversity mentioned above, can be discussed within the following framework (Pendleton-Julian, 2009, 2010):

1. While the studio is built around a specific issue and problem (real or hypothetical), the issues/problems are multidimensional. In this case, the learner has to be nourished by many fields of knowledge and be able to establish/follow the relationships between these fields.
2. The studio is social by nature. The learner learns with motivation, acquiring knowledge and skills from a creative position. It is a learning environment where one tests these knowledge and skills in dialogue with the facilitator and peers while putting them into practice.



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3. In the studio, criticism/discussion over the act of making and the resulting outcome of doing is the primary operator. While working in a field without a single direction or answer, feedback takes place through discussions as the learner articulates his ideas and suggestions with representation tools.
4. The studio is synthetic; synthesis occurs through repeated actions. In the studio, unlike normative pedagogies, the problem is not a focus awaiting a solution in accordance with specific rules but is a tool for productive inquiry. When this questioning occurs in an environment with more than one student, in a non-isolated manner, The learner will build knowledge by testing what he has acquired from a great variety.
5. At the most basic level, the studio supports knowledge-building and skills development. Instead of this being one-way, the studio tries to establish an environment where knowledge spreads and finds more ways within a community that learns by doing.
6. 'Studio culture,' which is frequently emphasized by accreditation institutions, refers to a learning environment where these conditions are met. (such as; MIAK: www.miak.org, NAAB: www.naab.org)

Based on this framework, it is necessary to focus on which potentials of the 'interactive new digital environment' can be associated with 'peer learning,' 'learning by doing' and 'socially situated learning' pedagogies and which new learning pedagogy can be theorized. Associating these pedagogies with 'gamification' can be discussed as a potential learning model.

Learning Theories Associated with the Design Studio

To thoroughly analyze the learning pedagogy of a studio and identify the key components that comprise the studio environment, it is crucial to look at the learning theories hinted in the framework. What are the essential factors, practices, and social dynamics contributing to creating a learning atmosphere in the studio? By examining five critical learning theories associated with the design studio pedagogy, we can gain a more profound insight into optimizing the studio's potential as a space for learning and development, benefiting both learners and educators.

One of the critical theories applied to the design studios is self-constructive learning, an approach to education that emphasizes the learner's active role in acquiring knowledge and skills (Ersine & Takkeci, 2017). It is a student-centered approach that emphasizes the development of critical thinking, problem-solving, and metacognitive skills (Torun, Tekçe, & Esin, 2011). In self-constructive learning, students are encouraged to take ownership of their learning and engage in inquiry and discovery. Self-constructive learning is based on the idea that learning is not a passive process but an active one that involves the construction of knowledge through integrating new information with existing knowledge. This approach recognizes that learners bring their experiences, beliefs, and perspectives to the learning process. These factors play a significant role in shaping their understanding of new material. Self-constructive learning is characterized by several key features, including using open-ended questions, promoting student autonomy, and emphasizing reflection and self-evaluation. Open-ended questions encourage students to explore a topic in-depth and develop their ideas and perspectives. Student autonomy is promoted through activities that allow students to choose what they learn and how they learn it. Reflection and self-evaluation help students monitor their progress and identify areas where they need additional support.



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Another theory associated with the design studio is the Zone of Proximal Development (ZPD), a term coined by Lev Vygotsky, a Russian psychologist and social constructivist, to describe the range of tasks a learner can perform with the guidance and assistance of a more knowledgeable other. It refers to the gap between a learner's current level of understanding and their potential level of experience with the help of an expert or a peer. According to Vygotsky, learning occurs when a learner can engage in activities beyond their current level of understanding but not so far beyond that they are unable to complete the task even with support (Vygotsky, 1980). In other words, the ZPD is where a learner can make the most progress in their learning. The ZPD is often illustrated as a range between what a learner can do independently and what they can do with assistance. Teachers and educators need to identify the ZPD of their students to provide appropriate guidance and support. By providing tasks within a student's ZPD, educators can help students progress in their learning by scaffolding their understanding and building on their prior knowledge (McLeod, 2022; Zhang et al., 2018). The ZPD is not a fixed concept and can change over time as a learner's understanding and skills develop. As learners progress and become more competent in a particular area, the ZPD shifts and expands, allowing them to take on more complex tasks more independently.

Built upon these theories, cognitive apprenticeship is a theoretical framework for learning that emphasizes the importance of social and cognitive processes in developing expertise. Collins, Brown, and Newman first introduced the concept of cognitive apprenticeship in the late 1980s to describe how experts transfer their knowledge and skills to novices (Brown, Collins, & Newman, 1987). The framework is based on the idea that learning is a social process that occurs through a combination of observation, imitation, and practice. In cognitive apprenticeship, learners are paired with expert practitioners who serve as mentors and guides in the learning process. These mentors allow learners to observe and participate in authentic tasks while providing feedback and support. A focus on developing metacognitive skills, such as problem-solving, decision-making, and self-evaluation, characterizes cognitive apprenticeship. The cognitive apprenticeship framework includes several critical principles designed to support learning and the development of expertise. These principles include modeling, coaching, scaffolding, articulation, reflection, and exploration (Dennen, 2003; Redmond, 1992). Modeling involves demonstrating expert thinking and behavior, such as using effective problem-solving strategies and techniques. Coaching consists of providing guidance and feedback to learners as they practice new skills and solve problems. Scaffolding involves gradually removing support as learners become more competent, allowing them to take on more complex tasks with increasing independence. Articulation involves the explicit description and explanation of the thought processes and strategies used by experts as they solve problems. Reflection consists of the opportunity for learners to review and evaluate their performance, focusing on identifying strengths and weaknesses. Exploration involves allowing learners to experiment with new ideas and approaches in a safe and supportive environment. The cognitive apprenticeship framework has been applied in various contexts, including education, training, and workplace learning. Research has shown that cognitive apprenticeship can effectively develop expertise, particularly in complex and dynamic domains with high uncertainty and ambiguity (Minschew, Olsen, & McLaughlin, 2021; Pieters & de Bruijn, 1992; Redmond, 1992).

As a critique of cognitive apprenticeship, Lave and Wenger (1991) introduced the concept of situated learning as a theoretical framework emphasizing the importance of context in acquiring and applying knowledge and skills. Learning can be viewed as an active process through



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meaningful and authentic engagement with specific social and cultural contexts. In this perspective, the transfer of knowledge is not a one-way street; rather, it is a continuous and dynamic construction that stems from the interaction between the learner and their environment. The emphasis here is on the value of authentic and relevant tasks that are directly tied to real-world contexts, as well as the importance of social interaction and collaboration in facilitating the learning process. By providing opportunities for learners to engage in relevant and meaningful activities, this approach aims to create an environment that encourages a deeper understanding of the subject matter and a more active and engaged approach to learning.

The "Projective Identity" theory by James Paul Gee emphasizes the significance of learners adopting new identities as they participate in learning and problem-solving endeavors. It proposes that learning encompasses more than just acquiring new knowledge and skills, but also involves a transformation of oneself (Gee, 2003, 2008). Gee suggests that learners can develop projective identities by adopting experts' attitudes, behaviors, and values in a specific domain. This requires learning new information and adopting a fresh perspective towards problems. In scientific fields, the projective identity concept holds particular importance as learners need to adopt a scientific mindset to engage in scientific inquiry effectively. By assuming the identity of a scientist, learners can approach problems systematically and analytically, employing creative problem-solving techniques essential to scientific discovery. This theory has significant implications for educators, who must create learning environments that facilitate learners in adopting new identities as they engage in learning activities. This may involve providing opportunities for learners to work alongside experts in a particular domain or engage in activities that enable them to adopt the attitudes and behaviors of experts. Overall, Gee's projective identity theory provides a valuable framework for understanding the role of identity in learning and problem-solving. It underscores the significance of developing learning environments that promote the formation of new identities and ways of thinking, particularly in fields that require a specific mindset for effective engagement.

Gamification as a Potential Unifying Framework For Distance Education

Gamification is a highly effective tactic that entails incorporating game-like elements into non-gaming contexts. According to Salen and Zimmerman (2003), the game is defined as a system in which players deal with an artificial problem, defined by rules, resulting in a measurable output. Game mechanics also create motivation to learn the situation in the game, focus attention, and can be used for continuous evaluation.

According to Shute and Ke (2012), the games designed have the following features:

1. Ongoing interactive solution generation
2. Specific goals and rules that keep the player focused and motivated
3. Adjusting the difficulty of the game and adapting the difficulty level according to the increasing knowledge and skills of the player
4. Player control of the game, the game environment, and the learning experience
5. Instant and continuous feedback
6. Uncertainty and surprise factors



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7. Keeping the player in the game through sensory stimulation through the use of different media

Games are of interest to educators as environments for digital literacy and expression, and as potential tools for learning (Bogost, 2005; Gee, 2003; Prensky, 2001). Many studies show that digital games help students improve their knowledge of certain concepts. According to Gee (Gee, 2008), well-designed games already benefit from specific learning theories. Learning science experts, educational content designers, and educators state that digital games can support knowledge (basic sciences, mathematics, language, etc.) and skills (problem-solving, critical thinking, and computational thinking). This potential brings forth studies such as game-based learning, game-based evaluation, serious games, educational games, and gamification.

Gamification has a similar set of learning supports that a design studio consists of and presents an opportunity waiting to be explored. These supports can be grouped under eight categories (Shute & Ke, 2012). The mechanics of game-based learning can be broken down into several categories, each with its tools and techniques. Reflection is one category that focuses on the learner's performance and aims to increase learning during the game. This can be achieved through various supports such as self-explanation, elaborations, and assignments. Modeling is another category that includes interpretations and examples of solving problems or performing tasks within the game. This category includes scaffolding, expert solutions, and working examples. Suggestion is a category that guides the learner from an expert or the game itself to get the learner moving in the right direction without revealing the solution. Collaboration is a crucial aspect of games that support all players to understand better the knowledge and skills required by discussing the game or a specific point in the game, which forms and maintains the community. Interaction and narrative components focus on supports created by giving learners more choice and control. Feedback is an important category that includes formative feedback, which is crucial for the learner. There are different types of feedback available, corrective (yes/no) and explanatory (indicating why the answers are correct/wrong) feedback being the most common. Finally, the modality is a category that focuses on the modalities (auditory, visual, textual) through which learning supports can be provided. Each type has a different impact on learning, which varies depending on the learning environment.

Considering these supports, gamification can be a robust strategy that can profoundly impact online design studios, specifically in creating immersive and compelling learning experiences for students to overcome. By integrating gamification techniques into the studio, instructors can motivate active participation and encourage creativity among students while simultaneously nurturing their problem-solving skills. The potential of gamification in providing students with invaluable design skills, such as critical thinking, collaboration, and communication, cannot be overstated. These skills are of utmost importance for success in architecture and can be effectively honed through the gamification of learning. By creating an engaging and interactive learning environment, students are more likely to be motivated and invested, leading to superior learning outcomes.

2. CONCLUSION

How will linear learning constructs respond to rapid cultural changes in disciplines that require individual autonomy, self-reaction, and self-awareness during the learning phase? Instead of tutor-centered and linear constructs that teach design education, can learning be decentralized,



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networked, systematic, scalable, and spontaneously adaptable by leveraging online new media opportunities and gamification processes?

Studying architectural design studio education requires diverse skills and a deep understanding of abstract concepts. To lay the foundation, students must possess a multi-faceted skill set and a nuanced comprehension of complex ideas, and this is a challenging process in online learning environments. Recent advancements in gamified educational products have shown the potential benefits of incorporating elements such as point systems and social networks to create a more engaging and interactive learning experience for design students. By utilizing these gamified elements, architecture design students can engage in an educational environment that promotes long-term retention of crucial concepts. It may also be beneficial as it allows instructors to motivate students, nurture their problem-solving skills, and promote creative thinking. This type of learning can also help students develop essential design skills such as critical thinking, collaboration, and communication. By creating a more engaging and interactive learning environment, students are more likely to be motivated and invested in their education, leading to better learning outcomes.

Despite the challenges posed by game literacy, scale, and implementation, gamification and game design principles offer a wealth of potential for enhancing the educational experience of architectural students. By presenting complex concepts like spatial understanding engagingly and interactively, these approaches pave the way for integrating new technologies in the field and promise to improve students' learning outcomes.

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**THE PERCEPTION OF HAZE FORMED ON URBAN REINFORCEMENT
ELEMENTS**

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ABSTRACT

The concept of visibility is the basic representation of the normal physical transparency of the atmosphere. Based on this explanation; visibility means the transparency of the air. Smoke, dust, humidity and water vapor suspended in the atmospheric environment interfere with the quality of vision. These suspended atmospheric phenomena constitute the main components of the haze. The concept of haze is a meteorological event that occurs when water vapor near the earth's surface condenses and the point of view is below 1 km. Haze prevents us from seeing the colors, forms and textures found in the natural landscape. Various visual impact studies have been evaluated. As a result of the evaluations, the visual elements of line, color, measure and texture were examined. Within the scope of the study; the effects of haze effect on readability at the reinforcement level in physical spaces were considered. In this context, recreation areas located in the Çanakkale city center have been preferred as a working area. The designated areas were supported by on-site observation, examination and photography. The study aims to evaluate haze perception in recreational landscape areas by landscape perception criteria. In this context; visual landscape perception criteria were determined, the current conditions of the designated areas were observed, examined and photographed, haze effect management was performed by determining the visual landscape perception value of the current situation, and recommendations were created to improve visual landscape perception values. During the evaluation, a decrement between 1-5 was made and suggestions were presented in terms of improving visual perception.

Keywords: The Concept of Haze, The Effect of Haze on the City, Visual Landscape Perception Values, the Concept of Haze in Çanakkale.

1. INTRODUCTION

The concept of visibility constitutes the basis of the physically present transparency of the atmosphere (Tang, et al., 2016). When viewed in this context, visibility is expressed as the transparency of the air. Smoke, dust, moisture and water vapor suspended in the atmosphere cause the formation of haze, which reduces visibility and prevents it (Watson, 2002). The basis of the haze structure is formed by these small particles suspended in the atmosphere. Particles present in the atmosphere reduce visibility all the time.



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According to the Korea Meteorological Administration, the concept of haze is defined as occurring when water vapor near the earth's surface condenses and reduces visibility below 1 km. Within the scope of this explanation, haze is defined as a meteorological event (Bei et al., 2016). Haze also affects the color, form, and texture of the natural landscape because it blocks vision. When viewed in this context, the intensity of the haze affects the extent to which we can see the natural landscape.

There are various visual impact assessment studies conducted. Various elements have been identified within the scope of these studies. These elements are; line, color, size, and texture. These identified elements enable users to perceive the natural landscape and place it in their memory.

Color, which is one of the visual effect elements, is the effect that occurs in the brain as a result of the reflection of light beams hitting objects. Colors enable objects to be perceived as far or near, hot or cold (Alakuş, 2009). Colors also form the perception of the spaces where they are located along with objects. The perception of temperature and coldness in places is provided by colors. The concept of color in landscape designs is vegetative and structural (water, soil, flooring, reinforcement element, etc.) constitute the themes. These elements, which are created harmoniously in the color angle, constitute a whole and unity.

Texture, which is one of the visual impact elements, is defined as the degree of smoothness on the surfaces of objects. Textured surfaces ensure the formation of perception for all users. For example, disabled walking paths located on walking paths allow visually impaired individuals to perceive the roads. At the same time, different textured surfaces can enable these individuals to perceive where they are. The concept of texture in the landscape changes depending on the existing plant area or the distance to the plant. If the current distance is far enough away from the plant area or plants that differences can be seen, the perception of texture will change depending on the plant grouping or the area covered by the plant. The plant groups created in the landscape should be of different textures. These groups with different textures seem more lively to users. But when trying to use different tissues, too much variety should also be avoided. Areas with too much diversity provide users with the perception of complexity and excessive mobility (Robinson, 2004).

The line, which is one of the visual impact elements, is the edge that causes the formation of shape and form. The line source is formed by natural means or man-made materials (Ayaşlıgil, 1998). There are lines in nature. But these lines are not strong, strong, and pronounced like pedestrian paths that are man-made. Branches, stems, leaf structures, and shadows of plants found in nature can be given as examples. The formation of leaf tissues and different colors found in plants allows the formation of imaginary lines (Walker, 1991).

There are different structures of the line, which is one of the visual impact elements. The horizontal lines in the landscape create a feeling of stillness and rest. Vertical lines, on the other hand, create a sense of size, mobility, and emphasis. Plants create an assertive, effective, and accentuating effect on the vertical lines found in the landscape in the field. The drooping lines used in the landscape attract attention and perception to the ground due to the energy and orientation they carry. Diagonal lines in the landscape, on the other hand, provide an exciting effect by energizing the area and the user (Robinson, 2004).

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The measure, which is one of the visual impact elements, covers the size differences of objects formed between each other. Dec. The sizes of the objects used in landscape designs should be proportional and in harmony with each other (Güney, 1992). When making designs, if the measurements of objects are made incorrectly, it creates physical and psychological negativity for the users. Physically occurring disadvantages can be exemplified in the form of difficulty in use, insufficient movement space, or more movement space than necessary. Psychological disadvantages can be exemplified in the form of feeling under pressure on narrow roads and feeling small in large terrace areas. At the same time, designs that cannot be made in accordance with the human scale also eliminate the perception of the beauty of spaces from the point of view of users (Uzun, 1999).

Within the scope of this study, the effects of haze, which is an atmospheric phenomenon, on the legibility and perceptibility of accessories and areas in physical spaces have been studied.

2. MATERIALS and METHODS

As a field of study; It constitutes recreation areas located in the center of Çanakkale, which is located within the boundaries of the city of Çanakkale. In determining the areas located in the city center, the areas included in the Sağlık ve Kelkit study (2014) were preferred. The preferred areas in this context are;

1. Yeni Kordon
2. Around Sarıçay
3. Halk Garden
4. Eski Kordon
5. Özgürlük Park



Figure 1. The Locations of the Study Areas in Çanakkale (by changing from Google Earth).

Within the scope of the study, a literature search was conducted in order to obtain information about the subject. Within the scope of the literature search; visibility, haze, which is a factor affecting visibility, and visual landscape perception, for concepts and studies related to articles, journals, books, etc. written sources were examined. On-site observations and investigations were carried out in the designated areas. In addition to these observations and investigations,



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on-site photography was carried out in the area and in the immediate vicinity. The findings made and obtained were evaluated within the scope of the determined criteria.

- The aim of the study is to evaluate the landscape areas with haze perception according to visual landscape perception criteria. The structure of the study;
- Determination of visual landscape perception criteria,
- On-site inspection, observation and photographing of the current conditions of the selected areas,
- Haze effect method to determine the visual landscape perception value of the current situation,
- It is in the form of evaluation within the scope of visual landscape perception values.

A haze effect has been given at 4 different rates on the photos taken to make field evaluations. After this haze effect was added to the photo, the visibility of color, form, line, texture and dimension in the haze effect was evaluated from visual landscape perception criteria. Scoring has been made for each evaluation. The scores made have been transferred to the tables. In the evaluation scoring; 1 point-does not appear at all, 2 points-does not appear, 3 points-may partially appear, 4 points-may appear and 5 points-may appear very well.

3. FINDINGS and DISCUSSION

Yeni Kordon

It is located between Hamidiye Tabya and Kolin Hotel from the north and south sides of Çanakkale city and between Atatürk Street and the sea from the east and west sides. Decadence of Çanakkale city is Decadence of Çanakkale city. It covers a total area of 20,480 square meters. 65% of the total area is designed as a hard floor and 35% is designed as a soft floor. As the predominant vegetation in the area; iğde (*Eleagnus sp.*), California fan palm (*Washingtonia filifera*), maple (*Acar sp.*), stunted pitosporum (*Pitosporum Tobias 'Nana'*) and oya tree (*Lagerstroemina indicated*) were used (Sağlık, 2014).

There are uses with different usage conditions in the field. These uses are residential areas, industrial and commercial areas, public spaces, and other areas. In this context, residential areas are multi-storey buildings. Areas located as public facilities; There are structures such as KYK administrative building, student dormitory, military facilities, and Çanakkale Meteorological Directorate. The sea-facing sides of these areas are generally planned as a garden (Sağlık, 2014). As other areas of use, there are kefes, walking paths, bicycle paths, otuma-recreation areas, children's playgrounds and open green areas. These areas allow users to do various recreational activities. Activities such as various concert events, open-air cinema have come to the fore recently. In this context, the usage intensity of the area has increased in recent periods.

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	COLOR	FORM	LINE	TEXTURE	MEASURE
a)	5	5	5	5	5
b)	4	4	4	4	4
c)	3	3	3	3	3
d)	2	2	2	2	2

Figure 2. Yeni Kordon walking path and bicycle path (Original, 2023).

The visual figure taken for the area where the Yeni Kordon walking and cycling path is located is given in Figure 2. Figure 2a refers to the visuals where the haze effect is 0%, Figure 2b where the haze effect is 33%, Figure 2c where the haze effect is 66%, and Figure 2d where the haze effect is 100%. An evaluation has been made in this context. The visual area given in Figure 2a can look very good (5 points) within the scope of landscape perception criteria (color, form, line, texture, and size). The landscape perception of the visual area given in Figure 2b is scored as visible (4 points) depending on the percentage of the applied haze effect. The landscape perception of the visual area given in Figure 2c is scored as partially visible (3 points) depending on the percentage of the applied haze effect. In Figure 2d, the landscape perception of the given visual area is scored as invisible (2 points) depending on the percentage of the applied haze effect. Within the scope of the evaluations, the fact that the area is open and the air flow is present prevents the haze rate from being visible at all (1 point) even when it is 100%.

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	COLOR	FORM	LINE	TEXTURE	MEASURE
a) 	5	5	5	5	5
b) 	4	4	4	4	4
c) 	3	3	3	3	3
d) 	2	2	2	2	2

Figure 3. Yeni Kordon children's playground (Original, 2023).

Yeni Kordon is given in the visual Figure 3 taken for the area where the children's playgroup is located. Figure 3a refers to the visuals where the haze effect is 0%, Figure 3b haze effect is 33%, Figure 3c haze effect is 66%, and Figure 3d haze effect is 100%. An evaluation has been made in this context. The visual area given in Figure 3a can look very good (5 points) within the scope of landscape perception criteria (color, form, line, texture and size). The landscape perception of the visual area given in Figure 3b is scored as visible (4 points) depending on the percentage of the applied haze effect. The landscape perception of the visual area given in Figure 3c is scored as partially visible (3 points) depending on the percentage of the applied haze effect. In Figure 3d, the landscape perception of the given visual area is scored as invisible (2 points) depending on the percentage of the applied haze effect. Within the scope of the evaluations, the fact that the area is open, by the sea and the air flow prevents the haze rate from being visible at all (1 point) even when it is 100%.

Around Sarıçay

It is located between Çamenlik Castle and Setboyu Street and DSI Sarıçay Avenues from the north and south sides of Çanakkale city, and between Troya Street and the sea from the east and west sides Dec. It covers a total area of 157,640 square meters. Sarıçay, which has a total length of 40 km, is fed by streams located on Kirazlı Mountain, Aladağ and Kayalı Mountain. 65% of the total area is designed as a hard floor and 45% is designed as a soft floor. As the predominant vegetation in the area; oleander (*Nerium oleander*), sycamore (*Platanus sp.*), larch (*Pinus nigra*), maple (*Acer sp.*), and acacia (*Acacia sp.*) have been used (Sağlık, 2014). Sarıçay Dardanelles divides the center into two and merges with the Bosphorus.

Sarıçay center, which is very important in terms of the history of Çanakkale, forms the boundaries of the New Cordon and the Old Cordon with its division into two. There are a total

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of 5 bridges over Sarıçay. These bridges are the transit routes that urban residents use extensively. There are grass areas, children's playgrounds, fishing shelters, cafe-restaurants, sitting-recreation areas, and jogging and walking areas in and around Sarıçay. These areas allow users to do various recreational activities.





	RENK	FORM	ÇİZGİ	DOKU	ÖLÇÜ	
a) 	5	5	5	5	5	COLOR
b) 	3	4	4	3	4	FORM
c) 	2	2	3	2	3	LINE
d) 	1	1	2	1	2	TEXTURE MEASURE

Figure 4. Sarıçay (Original, 2023).

The visual figure taken for the Sarıçay walking path and its surroundings is given in Figure 4. Figure 4a refers to the images where the haze effect is 0%, Figure 4b refers to the haze effect is 33%, Figure 4c refers to the haze effect is 66%, and Figure 4d refers to the haze effect is 100%. An evaluation has been made in this context. The visual area given in Figure 4a can look very good (5 points) within the scope of landscape perception criteria (color, form, line, texture, and size). The landscape perception of the visual area given in Figure 4b is scored as color and texture criteria may partially appear (3 points), form, line and measure may appear (4 points) depending on the percentage of haze effect applied. The landscape perception of the visual area given in Figure 4c is scored as color, form and texture are invisible (2 points), and line and measure are partially visible (3 points) depending on the percentage of haze effect applied. In Figure 4d, the landscape perception of the given visual area is scored as color, form and texture do not appear at all (1 point), line and measure do not appear (2 points) depending on the percentage of the applied haze effect. Within the scope of the evaluations, it is seen that it can Decipher the line and measurement criteria even if they are between 100% and none in terms of their length in the field and creating orientation.

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	COLOR	FORM	LINE	TEXTURE	MEASURE
a) 	5	5	5	5	5
b) 	3	4	4	3	4
c) 	2	2	3	2	3
d) 	1	1	2	1	2

Figure 5. Sariçay Bridge and its surroundings (Original, 2023).

The visual figure taken for the Sariçay bridge and its surroundings is given in Figure 5. Figure 5a refers to the visuals where the haze effect is 0%, Figure 5b refers to the haze effect is 33%, Figure 5c refers to the haze effect is 66%, and Figure 5d refers to the haze effect is 100%. An evaluation has been made in this context. The visual area given in Figure 5a can look very good (5 points) within the scope of landscape perception criteria (color, form, line, texture and size). The landscape perception of the visual area given in Figure 5b is scored as color and texture criteria may partially appear (3 points), form, line and measure may appear (4 points) depending on the percentage of haze effect applied. The landscape perception of the visual area given in Figure 5c is scored as color, form and texture are invisible (2 points), and line and measure are partially visible (3 points) depending on the percentage of haze effect applied. In Figure 5d, the landscape perception of the given visual area is scored as color, form and texture do not appear at all (1 point), line and measure do not appear (2 points) depending on the percentage of the applied haze effect. Within the scope of the evaluations, it is seen that it can Decipher the line and measurement criteria even if they are between 100% and none in terms of their length in the field and creating orientation.

Özgürlük Park

It is located between Özgürlük Street and Zübeyde Hanım Street from the north and south sides of Çanakkale and between Özgürlük Street and the military area from the east and west sides. It covers a total area of 57,000 square meters. 40% of the total area is designed as hard floor and 60% as soft floor. As the predominant vegetation in the area; oak (*Quercus L.*), ornamental plum (*Prunus ceracifera*), juniper (*Juniperus sp.*), oleander (*Nerium oleander*) and thuja (*Thuja sp.*) have been used (Sağlık, 2014).

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Özgürlük Park is an important recreation monument of the city of Çanakkale. There are various activity areas, a walking path, a bicycle path, an animal-friendly park, children's playgrounds, sports fields and a tea garden. These areas allow users to do various recreational activities. According to the location of the area, it sees the city and the Dardanelles Strait as a bird's eye view. There are relaxation areas and seating groups for users in this landscape area. There is mainly a grass texture as an open green area within the area. Users participate in activities such as concerts and various events on grass fields in summer. The user base is diverse because the area appeals to all age groups.





	RENK	FORM	ÇİZGİ	DOKU	ÖLÇÜ
a) 	5	5	5	5	5
b) 	4	4	4	4	4
c) 	3	3	3	3	3
d) 	COLOR	FORM	LINE	TEXTURE	MEASURE
	2	2	2	2	2

Figure 6. Özgürlük Park Landscape Area (Original, 2023).

The visual figure taken for the Özgürlük Park landscape area is given in Figure 6. Figure 6a refers to the images where the haze effect is 0%, Figure 6b refers to the haze effect is 33%, Figure 6c refers to the haze effect is 66% and Figure 6d refers to the haze effect is 100%. An evaluation has been made in this context. The visual area given in Figure 6a can look very good (5 points) within the scope of landscape perception criteria (color, form, line, texture and size). The landscape perception of the visual area given in Figure 6b is scored as visible (4 points) depending on the percentage of the applied haze effect. The landscape perception of the visual area given in Figure 6c is scored as partially visible (3 points) depending on the percentage of the applied haze effect. In Figure 6d, the landscape perception of the given visual area is scored as invisible (2 points) depending on the percentage of the applied haze effect. Within the scope of the evaluations, the fact that the area is open, high and has air flow prevents the haze rate from being visible at all (1 point) even when it is 100%.

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	COLOR	FORM	LINE	TEXTURE	MEASURE
a) 	5	5	5	5	5
b) 	4	4	4	4	4
c) 	3	3	3	3	3
d) 	2	2	2	2	2

Figure 7. Özgürlük Park lawn area (Original, 2023).

The visual taken for the Özgürlük Park lawn area is given in Figure 7. Figure 7a refers to the visuals where the haze effect is 0%, Figure 7b refers to the haze effect is 33%, Figure 7c refers to the haze effect is 66%, and Figure 7d refers to the haze effect is 100%. An evaluation has been made in this context. The visual area given in Figure 7a can look very good (5 points) within the scope of landscape perception criteria (color, form, line, texture and size). The landscape perception of the visual area given in Figure 7b is scored as visible (4 points) depending on the percentage of the applied haze effect. The landscape perception of the visual area given in Figure 7c is scored as partially visible (3 points) depending on the percentage of the applied haze effect. In Figure 7d, the landscape perception of the given visual area is scored as invisible (2 points) depending on the percentage of the applied haze effect. Within the scope of the evaluations, the fact that the area is open, high and has air flow prevents the haze rate from being visible at all (1 point) even when it is 100%.

Eski Kordon

It is located between between sea and İnönü Street from the north and south sides of Çanakkale city and between Piri Reis Street and Sarıçay from the east and west sides. It covers a total area of 67,000 square meters. 80% of the total area is designed as hard floor and 20% as soft floor. As the predominant vegetation in the area; sycamore (*Platanus sp.*), California fan palm (*Washingtonia filifera*), beech (*Fagus sp.*), ash (*Fraxinus sp.*) and Elm (*Ulmus sp.*) have been used (Sağlık, 2014).

According to the location of the Eski Kordon, it is the area with the most intensive use by urbanites. There are urban areas located in the area that cater to a wide variety and different uses. There are hotels, accommodation areas such as a police house, cafes, buffets, a walking path, a bicycle path, a marina, various hardware elements, a Trova horse statue, and a basketball

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court on the area. These areas allow users to do various recreational activities. In this context, it is used a lot by urbanites, especially in the summer months. Basketball tournaments, and various folk game shows are held on the field. On the other hand, various concerts and events are held on important days along the lanyard.





	COLOR	FORM	LINE	TEXTURE	MEASURE	
a)		5	5	5	5	5
b)		4	3	4	3	4
c)		2	2	2	2	2
d)		1	1	1	1	1

Figure 8. Eski Kordon walking path and the Trova Horse Statue (Original, 2023).

The visual figure taken for the Eski Kordon walking path and the Trova Horse area is given in Figure 8. Figure 8a refers to the visuals where the haze effect is 0%, Figure 8b refers to the haze effect is 33%, Figure 8c refers to the haze effect is 66%, and Figure 8d refers to the haze effect is 100%. An evaluation has been made in this context. The visual area given in Figure 8a can look very good (5 points) within the scope of landscape perception criteria (color, form, line, texture, and size). The landscape perception of the visual area given in Figure 8b is scored as color, line and measure may appear (4 points), form and texture may partially appear (3 points) depending on the percentage of haze effect applied. The landscape perception of the visual area given in Figure 8c is scored as invisible (2 points) depending on the percentage of the applied haze effect. In Figure 8d, the landscape perception of the given visual area is scored as not visible at all (1 point) depending on the percentage of the applied haze effect. Within the scope of the evaluations, the area is evaluated as not visible at all (1 point) if the haze rate is 100% due to the fact that the area is located in the city center and is low compared to other points.

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	COLOR	FORM	LINE	TEXTURE	MEASURE
a) 	5	5	5	5	5
b) 	4	3	4	4	4
c) 	3	2	3	3	2
d) 	2	1	2	1	1

Figure 9. Eski Kordon basketball court (Original, 2023).

The visual taken for the area of the Eski Kordon basketball court is given in Figure 9. Figure 9a refers to the visuals where the haze effect is 0%, Figure 9b refers to the haze effect is 33%, Figure 9c refers to the haze effect is 66%, and Figure 9d refers to the haze effect is 100%. An evaluation has been made in this context. The visual area given in Figure 9a can look very good (5 points) within the scope of landscape perception criteria (color, form, line, texture and size). The landscape perception of the visual area given in Figure 9b is scored as color, line, texture and dimension may appear (4 points), and form may partially appear (3 points) depending on the percentage of haze effect applied. The landscape perception of the visual area given in Figure 9c is scored as color, line and texture are partially visible (3 points), and form and measure are not visible (2 points) depending on the percentage of haze effect applied. In Figure 9d, the landscape perception of the given visual area is scored as color and line do not appear (2 points), form, texture and size do not appear at all (1 point) depending on the percentage of haze effect applied. The reason why the color and line are perceived more in the 100% haze effect of the area than other criteria within the scope of the evaluations made is that the preferred colors and colors create lines. Burgundy, blue and white colors are the colors that are more intense to be perceived in the user's memory.

Halk Garden

It is located between Ziverbey Street and Mehmet Dec between the north and south sides of Çanakkale City and between İnönü Street and Kayserili Ahmet Paşa Street from the east and west sides. It covers a total area of 34,188 square meters. 25% of the total area is designed as hard floor and 75% as soft floor. Elm (*Ulmus compestris*), red pine (*Pinus brutia*), ash (*Fraxinus excelsior*), cypress (*Cupressus sempervirens*), and ash-leaved maple (*Acer negunda*) were used as the predominant vegetation in the area (Sağlık, 2014). Apart from these plantings, there are various shrub groups and seasonal plants in the area.

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The presence of dense groups of trees in the area creates a canopy for the area. The presence of these canopy areas is preferred because it makes the area cool in summer. Due to its proximity to locations such as the old state hospital, the old cordon, and the pier, it creates a transition area for urbanites other than the recreation area. Various areas such as children's playgrounds, sports equipment, cafe-restaurant, amphitheater, and animal-friendly parks cater to various age groups within the area. These areas allow users to do various recreational activities. The area is one of the areas with the most intensive use in the city due to its location and location in the city center. It is an area that allows urban residents to escape from their concreted life and breathe in green tissue.

	RENK	FORM	ÇİZGİ	DOKU	ÖLÇÜ	
a)	5	4	4	5	4	
b)	4	3	4	3	4	
c)	3	2	3	2	3	
		COLOR	FORM	LINE	TEXTURE	MEASURE
d)	2	1	2	1	2	

Figure 10. Halk Garden Red Tile Semolina walking path

The visual Figure taken for the Halk Garden red tile semolina walking path area is given in Figure 10. Figure 10a refers to the visuals where the haze effect is 0%, Figure 10b haze effect is 33%, Figure 10c haze effect is 66%, and Figure 10d haze effect is 100%. An evaluation has been made in this context. Within the scope of the landscape perception criteria of the visual area given in Figure 10a, the color and texture can look very good (5 points), and the form, line and measure can be seen (4 points). The landscape perception of the visual area given in Figure 10b is scored as color, line and texture may appear (4 points), form and texture may partially appear (3 points) depending on the percentage of haze effect applied. The landscape perception of the visual area given in Figure 10c is scored as color, line and measure are partially visible (3 points), and form and texture are not visible (2 points) depending on the percentage of haze effect applied. In Figure 10d, the landscape perception of the given visual area is scored as color, line and measure do not appear (2 points), form and texture do not appear at all (1 point) depending on the percentage of the applied haze effect. The reason why color, line, and measure are perceived more in the 100% haze effect of the area than other criteria within the scope of the evaluations made is that the preferred colors and colors create lines. The perceived lines, on

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the other hand, are effective in the measurement degree of the area. Red is a color that is more intense to be detected in the user's memory. At the same time, red and green colors are opposite colors to each other. This also allows it to be perceived more intensely in two colors.





	COLOR	FORM	LINE	TEXTURE	MEASURE
a) 	5	4	5	5	5
b) 	4	4	4	4	4
c) 	3	3	3	2	3
d) 	1	2	2	1	2

Figure 11. Halk Garden Slate Stone walking path

The visual Figure taken for the slate stone walkway area of the Halk Garden is given in Figure 11. Figure 11a refers to the images where the haze effect is 0%, Figure 11b where the haze effect is 33%, Figure 11c where the haze effect is 66%, and Figure 11d where the haze effect is 100%. An evaluation has been made in this context. Within the scope of the landscape perception criteria of the visual area given in Figure 11a, the color, line, texture and size can look very good (5 points), and the form is scored as visible (4 points). The landscape perception of the visual area given in Figure 11b is scored as visible (4 points) depending on the percentage of the applied haze effect. The landscape perception of the visual area given in Figure 11c is scored as color, form, line and measure are partially visible (3 points), texture is not visible (2 points) depending on the percentage of haze effect applied. In Figure 11d, the landscape perception of the given visual area is scored as form, line and measure do not appear (2 points), color and texture do not appear at all (1 point) depending on the percentage of the applied haze effect. The reason why the form, line and dimension are perceived more in the 100% haze effect of the area than other criteria within the scope of the evaluations is related to the material used on the walking path. The form of the slate stone material, the lines it creates and the way it is used in the area have made it more prominent compared to other criteria depending on the harmony of measurement.

4. CONCLUSION and RECOMMENDATIONS

Various atmospheric events occur on Earth. The name of the atmospheric phenomenon formed by various particles suspended above the atmosphere is haze. Due to the formation of haze, it



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is a weather event that prevents visibility. The low visibility prevents the perception of spaces and spaces for users. With the increase in the amount of haze, visual impact affects the evaluation criteria (color, form, line, texture and size) to different degrees in terms of visibility. Preferred locations within the scope of the study; These are the areas located in the Çanakkale city center where urbanites can do recreational activities and are intensively used by urbanites. A haze effect was added to the field images photographed on-site and their legibility was evaluated with a scoring system within the scope of visual landscape criteria.

If a general assessment of the preferred areas is made;

- Yeni Kordon; both of the preferred positions in the area create the same perception of the haze effect. With the increase of the haze effect, the visibility rate has decreased.
- Sarıçay; Both of the preferred locations in the area create the same perception of the haze effect. With the increase of the haze effect, the visibility rate has decreased.
- Özgürlük Park; Both of the preferred locations in the area create the same perception of the haze effect. With the increase of the haze effect, the visibility rate has decreased.
- Eski Kordon; both of the preferred locations in the area have created different perceptions of the haze effect. The most basic of these differences is the color and line criteria found in the fields. With the increase of the haze effect, the visibility rate has decreased at a certain rate.
- Halk Garden; Both of the preferred locations in the area have created different perceptions of the haze effect. The most basic of these differences is the color, form, and texture criteria. Along with the haze effect, the visibility rate has decreased at a certain rate.

Within the scope of the evaluations, as the amount of haze increased, the visibility of the colors of the ground and reinforcement materials decreased. The visibility of the floor coverings and reinforcement elements selected in light colors is slightly higher in those used with colors that are opposite to the less dark. With the decrease in the visibility of the color criterion, the visibility of the form, line, texture, and measurement criteria also decreases. The color criterion forms the basis of the concept of form and line. Form and line form the basis of texture and measure. When viewed in this context, it can be said that all the criteria are related to each other. In this context, the visibility of users decreases during dense haze and it becomes difficult for them to perceive places.

Thanks and Information Note

Thank you for reading.

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ENERGY-EFFICIENT RETROFITTING AND COST ANALYSIS OF EXISTING BUILDINGS THROUGH ENERPHIT STANDARD: YENİŞEHİR WORKER HOUSING

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ABSTRACT

In this study, the aim is to ensure the cultural and social continuity of Yenişehir worker housing, designed to meet the accommodation needs of workers during the establishment of the Karabük Iron and Steel Factory. The objective is to improve the buildings to passive house conditions by following the EnerPHit Standard. To achieve this, the current energy consumption data of worker housing located on the 7th island in Yenişehir neighborhood was determined, and enhancement proposals were made by reinforcing building envelope elements with highly insulating materials. The goal was to transform the housing into a zero-energy building by selecting insulation materials from natural, artificial, and advanced technology categories. Additionally, a cost analysis of the chosen insulation materials was performed to identify the optimal one. As the thermal conductivity coefficient of selected insulation materials decreases, the required thicknesses also decrease. Natural insulation materials have higher thermal conductivity coefficients compared to artificial and advanced technology categories, resulting in thicker layers. On the other hand, advanced technology insulation materials have significantly lower thermal conductivity coefficients, requiring thinner layers. The cost analysis revealed up to 35-fold differences in insulation prices, making cellulose spray, natural insulation, the most cost-effective, and aerogel panels, advanced technology insulation, the most expensive among the examined materials. While the costs of natural and artificial insulation materials are close to each other, it is evident that advanced technology insulation materials are considerably more expensive. This study is expected to serve as a guiding reference for zero-energy building designers, architects, and decision-makers.

Keywords: Zero-energy Building, Improvement, Thermal Insulation Materials, Cost.

1. INTRODUCTION

As a result of technological advancements, population growth, and changing lifestyles worldwide, energy consumption is increasing day by day. The construction sector is recognized as a significant contributor to the total energy consumption. Globally, the construction sector accounts for approximately 36% of total energy consumption (UN Environment and International Energy Agency, 2017). According to the European Commission, buildings are held responsible for about 40% of energy consumption in the European Union (European Commission, 2021).



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As a solution to the substantial energy consumption attributed to the construction sector worldwide, passive houses are emerging as a prominent option. Passive houses are structures that provide thermal comfort conditions with minimal energy usage. They are designed to integrate with climatic data and are environmentally friendly and energy-efficient buildings (Duran and Kartal, 2021). The Passive House Institute has developed the Passive House Standard for new constructions and the EnerPHit Standard for existing buildings (Aşıkoğlu et al., 2021).

There are five fundamental principles used in the construction of passive houses. These principles include high levels of thermal insulation in the opaque building envelope, design without thermal bridges, an airtight building envelope, high thermal resistance windows and doors, and heat recovery ventilation with high-efficiency features (Passive House Institute, 2023). In passive houses, high-thickness thermal insulation is applied to the building envelope to ensure energy conservation. Thermal insulation materials play a crucial role in reducing energy demand and fuel consumption during the building's usage phase.

In this context, the objectives of the study can be outlined as follows:

- Identifying the existing energy consumption data of the Yenişehir workers' housing.
- Improving the energy consumption of this housing according to the Passive House EnerPHit Standard.
- Conducting a cost analysis of the insulation materials recommended for energy improvement.

In this context, the study encompasses determining the characteristics of the building envelope elements of the Yenişehir workers' housing, simulating this housing to identify its current energy consumption, generating recommendations for improving the workers' housing according to the Passive House EnerPHit Standard, enhancing the building envelope elements with insulation materials in the recommendations to reduce the energy consumption of the buildings, and conducting cost analyses of the insulation materials used in the recommendations.

2. MATERIALS and METHODS

Within the scope of the study, a worker's housing referred to as Type A1, located in the Yenişehir neighborhood of Karabük, has been selected as the research area. Yenişehir neighborhood and the worker's housing units therein hold significant importance for Karabük. With the opening of the Iron and Steel Factory, Karabük began its transformation into an industrial city. In order to address the housing needs of the factory workers, a modern and exemplary neighborhood was established in Yenişehir.

The worker's housing is constructed using a masonry building system. This Type A1 housing unit is created by placing two blocks side by side. The base area for a single block is approximately 70 square meters, resulting in a total base area of approximately 140 square meters for both blocks combined. The housing unit features a plan with dimensions of 13 meters by 14 meters, including protrusions and recesses. The two blocks are designed as exact mirror images of each other. The housing unit is single-story, with a floor height of 3 meters. It has a pitched roof, designed as a cold roof. The unit includes a kitchen, living room, 2 bedrooms, and wet areas. The plan, section, and elevation of the housing unit are provided in Figure 1.

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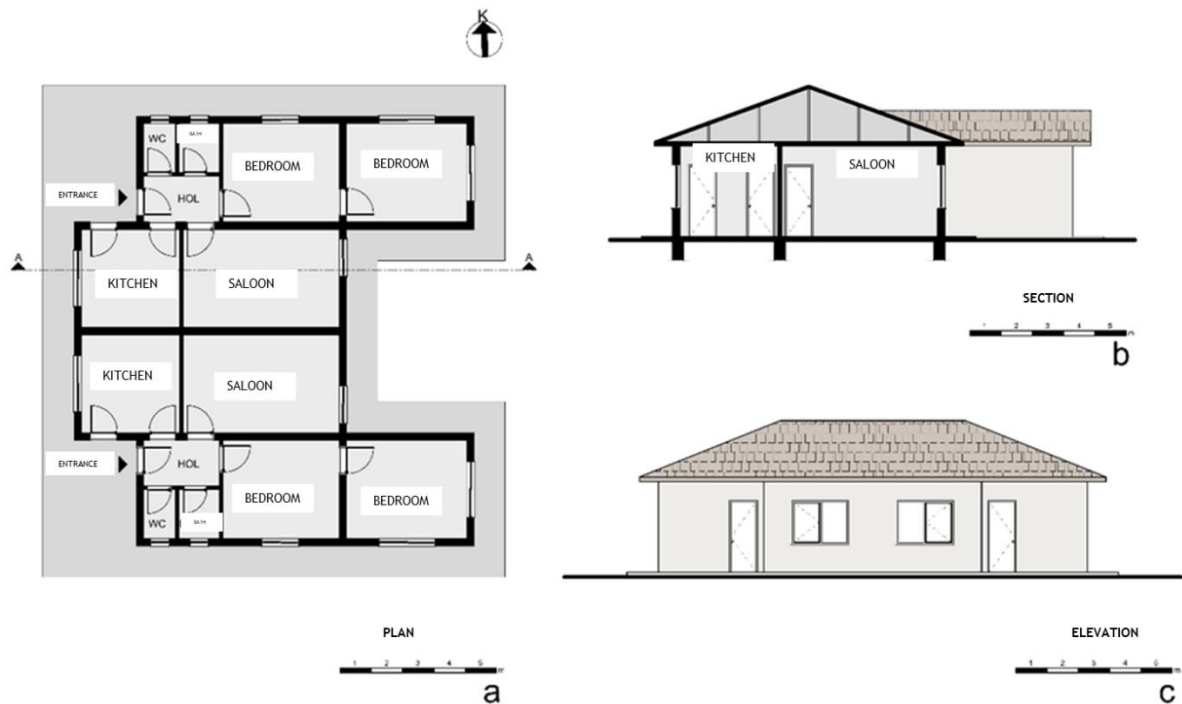


Figure 1. A1 type worker's housing a) plan, b) section, c) elevation (Adapted from Karabük Municipality, 2020).

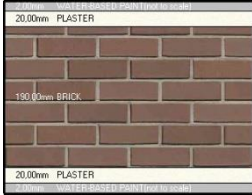

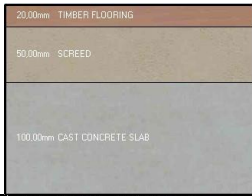


The worker's housing utilizes brick as the wall-filling material. The windows consist of PVC frames and double glazing. Detailed material information for the housing is provided in Table 1.

In the study, the existing energy consumption of the house and the energy consumption of the improvement proposals created within the scope of the EnerPHit Standard were determined through the DesignBuilder simulation program. Elitech RC-51H device was used to measure and record indoor temperature data and verify the outputs calculated by the simulation program.

To determine the current status of the A1 type worker housing in terms of energy consumption, the properties of the elements that make up the building were examined and the energy consumption of the building was determined. First, the material layers of the components that make up the existing building envelope were examined and the heat transmission resistance (R-value) of the building envelope was calculated. Then, the dwelling was modeled in the DesignBuilder program, the required parameters were entered and simulated to determine the current energy consumption. Table 2 shows the thickness, thermal conductivity coefficient and thermal transmission resistance of the building envelope components.

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Table 1. Existing material layers of the worker's dwelling and their heat transmission resistance (R value).

Components	Materials	Layers
Exterior wall	Water-Based Plastic Paint 2cm Exterior Plaster 19cm Brick 2cm Interior Plaster Water-Based Plastic Paint	Ext 
		Int
Interior wall	Water-Based Plastic Paint 1.5cm Interior plaster 8.5cm Brick 1.5cm Interior plaster Water-Based Plastic Paint	Int 
		Int
Ground Floor	2cm Wooden Floor Covering 5cm Screed Concrete 10cm Rough Concrete Slab	Int 
		Ext
Roofing Slab	Water-Based Plastic Paint 2cm Ceiling Plaster 10cm Reinforced Concrete Slab 5cm Screed Concrete	Int 
		Ext
Pitched Roof	2cm Marseille Type Roof Tiles 3cm Roof Sheathing Board	Ext 
		Int

In order to determine the current energy consumption of Yenişehir worker housing, the housing was modeled in the DesignBuilder simulation program, data was transferred to the program, and simulation was performed by defining the assumptions in the program. The current climate data of Karabük, the city where the worker housing is located, was taken from the NASA POWER database, which was developed by NASA and provides meteorological data, in epw file format. The current climate data received in epw format was defined in the DesignBuilder program. The data entered into the program and the model of the house created in the program are given in Table 3.

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Table 2. The existing material layers and thermal resistance (R-value) of the worker housing.

Envelope	Materials	Thickness (m)	Coefficient of Thermal Conductivity (λ) (W/mK)	Heat Transmission Resistance (R) ($\text{m}^2\text{K/W}$)
Layers of exterior wall				
Ext 	Exterior plaster	0.02	0.5	0.04
	Brick	0.19	0.72	0.26
	Interior plaster	0.02	0.5	0.04
	$R_{\text{ex}} + R_{\text{int}}$			0.04+0.13
	R_{ex wall}			0.51 $\text{m}^2\text{K/W}$
	U_{ex wall}			1.96 $\text{W/m}^2\text{K}$
Layers of roofing				
Int 	Roofing plaster	0.02	0.5	0.04
	Reinforced Concrete Slab	0.1	2.30	0.04
	Leveling Concrete	0.05	0.41	0.12
	$R_{\text{ex}} + R_{\text{int}}$			0.04+0.13
	R_{roof}			0.37 $\text{m}^2\text{K/W}$
	U_{roof}			2.7 $\text{W/m}^2\text{K}$
Layers of ground floor				
Int 	Wooden Floor Covering	0.02	0.14	0.14
	Leveling Concrete	0.05	0.41	0.12
	Concrete	0.1	1.13	0.09
	$R_{\text{ex}} + R_{\text{int}}$			0.04+0.13
	R_{ground}			0.52 $\text{m}^2\text{K/W}$
	U_{ground}			1.92 $\text{W/m}^2\text{K}$

Suggestions have been created for the improvement of Yenişehir worker housing towards the EnerPHit Standard developed by the Passive House Institute for existing buildings. Karabük province, where the worker housing is located, is located in the cold temperate climate zone according to the Passive House climate classification (SEPEV; 2018 translated from iPHA,



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2018). The criteria required for a building in this climate zone to meet the Passive House EnerPHit Standard are given in Table 4.

Table 3. Data entered into the DesignBuilder program and the model of the dwelling.

Parameters	Properties
Building Function, Number of Users	House, 4 people
Heating-Cooling Set Point Range	18°C - 24°C
Heating Programming	January-February-March-April-May and September-October-November-December
Cooling Programming	June-July-August
Heating and Cooling System	Natural Gas Radiator + Electric Air Conditioner
Unheated-Cooled Units	Wet Areas and Attic
Air Tightness Value	0.7 ac/h

Model

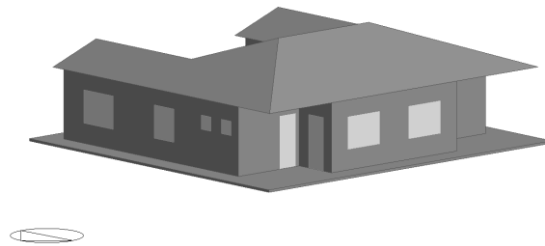


Table 4. EnerPHit criteria for the cold temperate climate zone (modified from Passive House Institute, 2016 translated from SEPEV, 2022).

EnerPHit Criteria for Components	
U Value (Heat Transmission Coefficient)	Opaque Building Envelope $\leq 0.15 \text{ W/m}^2\text{K}$ Exterior Doors and Windows $\leq 0.85 \text{ W/m}^2\text{K}$
Heat Recovery Rate	$\geq 75\%$
EnerPHit Criteria for Energy Demand	
Heating Demand	$\leq 25 \text{ kWh/m}^2 \text{ y1l}$
General EnerPHit Criteria	
Air Tightness	$\leq 1.0 \text{ ac/h}$
Primary Energy Demand	$\leq 120 \text{ kWh/m}^2 \text{ year}$

According to this schedule, buildings must meet the EnerPHit criteria for either the component method or the energy demand method. While it is sufficient to fulfill the criteria of one of these two methods, in addition, the general EnerPHit criteria must be met. In this study, improvement



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proposals have been developed to fulfill both the component method, the energy method and the general EnerPHit criteria.

It was decided to use more than one thermal insulation material in the recommendations to be created for the improvement of workers' housing for the EnerPHit Standard. Since the other parameters should be the same for all thermal insulation materials, the improvement proposals were divided into two consecutive steps: common and thermal insulation and improvement proposals.

Firstly, the parameters to be used common to all thermal insulation proposals, such as the selection of highly thermally insulated Windows-exterior doors, the selection of a highly efficient heat recovery HVAC system and the air tightness value, were determined. The DesignBuilder program does not give the total U-value of the window. Therefore, the U-value of the window consisting of glass and frame selected in the program was calculated with the equation used by the Passive House Institute to determine the window U-value. The common retrofit parameters were determined as given in Table 5 and the EnerPHit Standard criteria were met for these parameters for the cold temperate climate zone.

Table 5. Joint improvement decisions

Joint Improvement Decisions	
Windows (3 different)	0.71 W/m ² K, 0.74 W/m ² K ve 0.77 W/m ² K 3-pane Argon Filled Low-e Glass, PUR Insulated Frame
Exterior Door	0.73 W/m ² K Insulated Door with PUR
HVAC System	Heat Recovery VRF System Heat Recovery Rate 85
Air Tightness	0.6 ac/h.

After the common improvement recommendations were identified, recommendations for improvement with thermal insulations to increase the heat transmission resistance of opaque building envelope elements were created. In accordance with the EnerPHit Standard, retrofitting with thermal insulations should be carried out in the opaque shell components of the buildings: exterior wall, roof slab and floor slab. In the retrofit recommendations, thermal insulation materials were decided and the thicknesses of these thermal insulation materials that should be in the opaque shell components were determined. Within the scope of this study, the classification of thermal insulation materials in the categories of natural, artificial and advanced technology is discussed. The selected thermal insulation materials and their properties are given in Table 6 and the required thicknesses are given in Table 7.

In the study, a cost analysis of improvement scenarios with thermal insulations was made. The cost analysis was made based on "1m² thermal insulation" used in the exterior wall. The costs of the thermal insulations used in the 1m² exterior wall were determined according to the



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calculated thicknesses in the improvement proposals. The prices of thermal insulation materials were obtained from the companies according to the dimensions of "1m² x 1cm thickness". The price information of thermal insulation materials in "1m² x 1cm thickness" unit and the companies from which prices were obtained are given in Table 8. The prices of thermal insulations were obtained in May 2023.

Table 6. Selected thermal insulation materials and their properties.

Thermal Insulation Materials	Coefficient of Thermal Conductivity (λ) (W/mK)	Density (kg/m ³)
Natural Thermal Insulation Materials		
Sprayed Cellulose	0.039 W/mK	50 kg/m ³
Artificial Thermal Insulation Material		
EPS Sheet	0.034 W/mK	25 kg/m ³
Advanced Technology Thermal Insulation Material		
Aerogel Sheet	0.015 W/mK	200 kg/m ³

Table 7. Selected thermal insulation materials and thicknesses required for the building envelope.

	Coefficient of Thermal Conductivity (λ) (W/mK)	Ext. Wall (cm)	Roofing (cm)	Ground Floor (cm)
Natural Thermal Insulation Materials				
Sprayed Cellulose	0.039	24.5	24.5	23.5
Artificial Thermal Insulation Material				
EPS Sheet	0.034	21	21	20.5
Advanced Technology Thermal Insulation Material				
Aerogel Sheet	0.015	9.5	9.5	9.5

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Table 8. Price information of thermal insulation materials and companies from which prices are obtained.

Thermal Insulation Materials	Price (1m ² x 1cm)	Firm
Natural Thermal Insulation Materials		
Sprayed Cellulose	0.5 Euro + % 18 KDV	CELLUBOR Heat and Sound Insulation
Artificial Thermal Insulation Material		
EPS Sheet	0.75 Euro + % 18 KDV	AUSTROTHERM Insulation Materials
Advanced Technology Thermal Insulation Material		
Aerogel Sheet	45 Euro + % 18 KDV	AMA AEROGEL

3. FINDINGS and DISCUSSION

As a result of the energy simulation of the worker's dwelling, the current heating, cooling and primary energy demand of the dwelling was obtained. The findings for these demands are given in Figure 2.

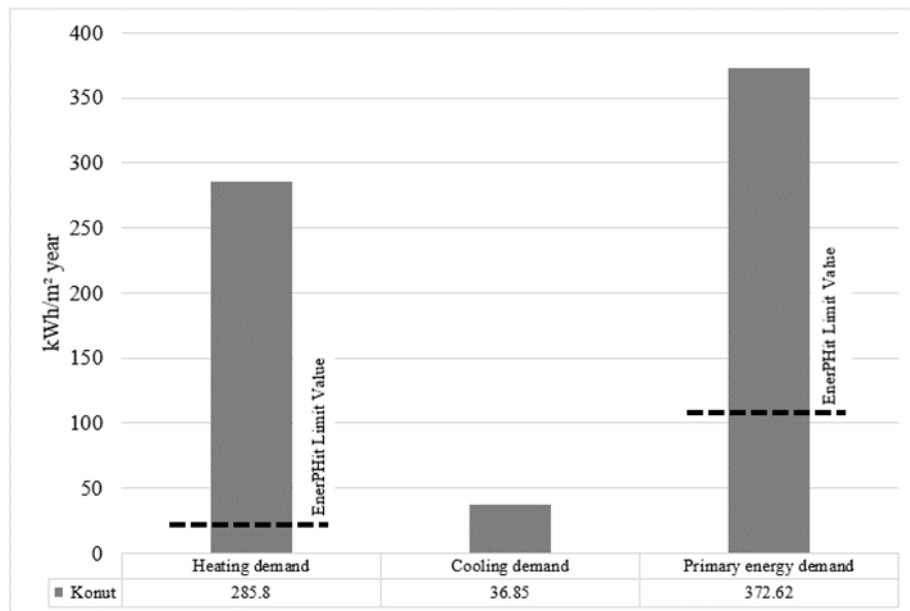


Figure 2. Current energy consumption of the worker's dwelling.

It can be said that the heating demand of this worker's dwelling, whose energy consumption was determined, is quite high and heating demand constitutes the majority of primary energy demands. The baseline energy performance results show that this dwelling is far from the EnerPHit Standard criteria for the cold temperate climate zone.



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The improvement proposals of the worker's dwelling for the EnerPHit Standard were modeled in the DesignBuilder program, the necessary parameters were defined and energy simulations were carried out. The findings for heating, cooling, and primary energy demands obtained as a result of the simulations of the improvement proposals of the dwelling are given in Table 9.

Table 9. Energy consumption of worker housing retrofit proposals.

	Heating demand (kWh/m ² year)	Cooling demand (kWh/m ² year)	Primary energy demand (kWh/m ² year)
Sprayed Cellulose	22.660	19.612	113.69
EPS Sheet	22.422	19.356	113.13
Aerogel Sheet	21.112	18.663	111

When the findings obtained as a result of the energy simulation of the improvement proposals created with 3 different insulation materials for the worker's dwelling are examined;

- In the improvement proposals compared to the current situation; heating demand decreased by approximately 90%, cooling demand decreased by approximately 45% and primary energy demand decreased by approximately 70%.
- The largest reductions in improvement recommendations compared to the baseline are in heating and primary energy demand, and the smallest in cooling demand, respectively.
- All 3 improvement proposals meet the EnerPHit Standard criteria of 25 kWh/m² for maximum heating demand and 120 kWh/m² for maximum primary energy demand.
- In all 3 proposals, heating, cooling and primary energy demands are close to each other and differ slightly. This situation can be explained by the fact that the insulation thickness sensitivity is taken as 0.5cm and accordingly, the R values are not equal.

Among the improvement suggestions for the EnerPHit Standard, the cost analysis of the thermal insulation materials used in the exterior wall was made. In the cost analysis of thermal insulation materials, the unit was determined as "1m² thermal insulation". Prices were calculated for the required thicknesses (1m² x required thickness) determined in the improvement suggestions. The price information of thermal insulation materials in units of "1m² x required thickness" is given in Figure 3.

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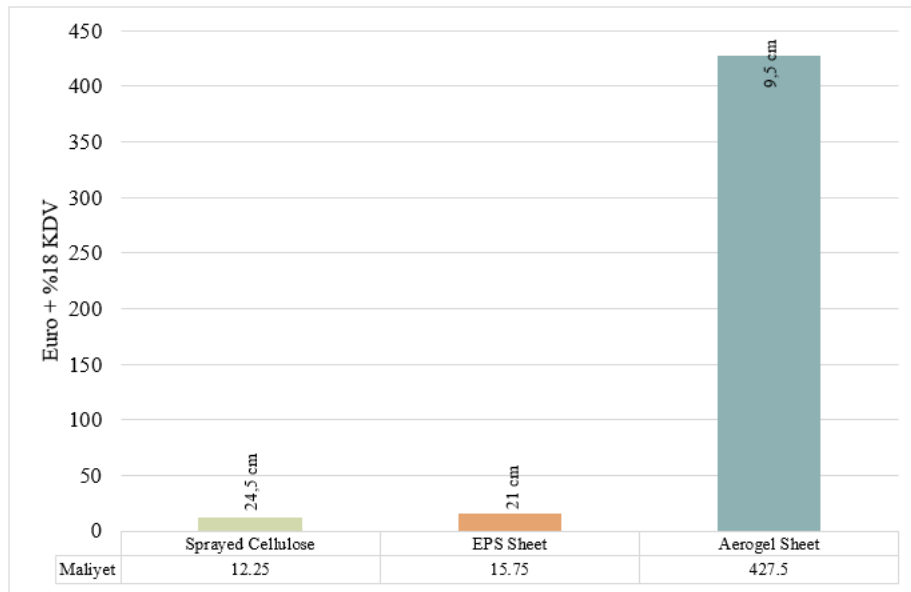


Figure 3. Costs of thermal insulations for the unit "1m² x required thickness"

When the prices of thermal insulation materials are analyzed based on "1m² x required thickness";

- Sprayed cellulose, which is natural thermal insulation, is the lowest-priced thermal insulation material with a price of 12.25 Euro + 18% VAT,
- Aerogel board, an advanced technology thermal insulation, is the highest priced thermal insulation material with a price of 427.5 Euro + 18% VAT,
- It is seen that there is a difference of approximately 35 times between the prices of these two thermal insulation materials with the lowest and highest prices.

It can be said that the prices of natural and artificial thermal insulation materials are close to each other for both "1m² x 1cm thickness" and "1m² x required thickness" units, but the price of high-tech thermal insulation materials is considerably higher than natural and artificial thermal insulations. For both units, sprayed cellulose, which is one of the natural thermal insulations, is the lowest-priced insulation material.

4. CONCLUSION and RECOMMENDATIONS

In all of the thermal insulation improvement proposals used in the improvement of Yenişehir workers' housing within the scope of EnerPHit Standard, results in compliance with the EnerPHit Standard were obtained. It has been observed that the insulation thicknesses calculated according to the thermal conductivity coefficients in order to meet the building envelope heat transmission coefficient criterion of the EnerPHit Standard differ up to 2.5 times. While the thickness of natural thermal insulation is quite high, the thickness of artificial thermal insulation is relatively less and the thickness of advanced technology thermal insulation is quite small. While each of the thermal insulations gives very close results in terms of energy performance, it should be taken into consideration that those with high thicknesses may create negative situations in terms of aesthetics, usability and burden on the structure by creating extra thickness in walls and floors.



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In the cost analysis for cost-effective improvement of houses, it was seen that insulation prices differ up to 35 times. Among the thermal insulations analyzed, it can be said that sprayed cellulose, which is a natural thermal insulation, has the lowest cost and aerogel board, which is an advanced technology thermal insulation, has the highest cost. While the costs of natural and artificial thermal insulations are close to each other, it is possible to say that the cost of advanced technology thermal insulation is quite high.

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EFFECT OF MOISTURE ON THE STRENGTH OF CROSS-LAMINATED TIMBER

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ABSTRACT

Wood and mass timber panels are susceptible to moisture, which can lead to the growth of fungi and insects, resulting in a decrease in the strength and displacement capacity. CLT (Cross Laminated Timber), is one of the most widely used engineered products in modern timber structures, and connections within CLT structures are made using hold-downs/brackets fixed with metal nails/screws to provide required ductility. Swelling and shrinkage of these panels due to humidity and corrosion of nails/screws may impact the structural performance of both the panels and the system. Handbooks on mass timber structures cover the effects of moisture on the structure and ways to prevent moisture damage, the values relating to moisture content and methods of measuring moisture content are specified in the standards. However, a standardized test method for investigating the relationship between moisture and strength has not yet been defined. There is very limited research on how moisture relates to strength in structural timber. This study aims to investigate the properties and relations between CLT, moisture, and strength by reviewing existing literature. Examining experimental results show that moisture hurts timber and the effect of moisture should be taken into consideration in structures.

Keywords: Cross Laminated Timber (CLT), Moisture, Strength.

1. INTRODUCTION

Wood has been one of the most widely used building materials for centuries due to its high strength, accessibility, and ease of use, but it is an anisotropic and hygroscopic material. It has different properties in different directions and its relationship with water is quite strong, and this causes dimensional changes through swelling and shrinkage (Figure 1). To eliminate the mechanical weaknesses of wood, mass timber panels (MTP) are produced by industrial processing and gluing. These industrial wood products possess high strength, ease of application, and recyclability, in addition to their environmentally friendly and sustainable nature (Ayanleye et al., 2022). CLT, LVL, Glulam, NLT, and DLT are the most used timber composite products. These structural mass timber panels are used as load-bearing walls and flooring in construction and provide desired performance demands e.g., fire resistance, rigidity, and durability. However, like wood, engineered timber products are more vulnerable to moisture than other building materials. Moisture ingress plays a vital role in the degradation, reducing its strength and displacement capacity, and causing fungal/insect growth and

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biological decay. (Figure 2). Under these circumstances, wood products become less desirable when interacting with water and moisture. Humidity affects density, strength, stiffness, swelling, and shrinkage along with the structure of the wood (Kuklik, 2008).

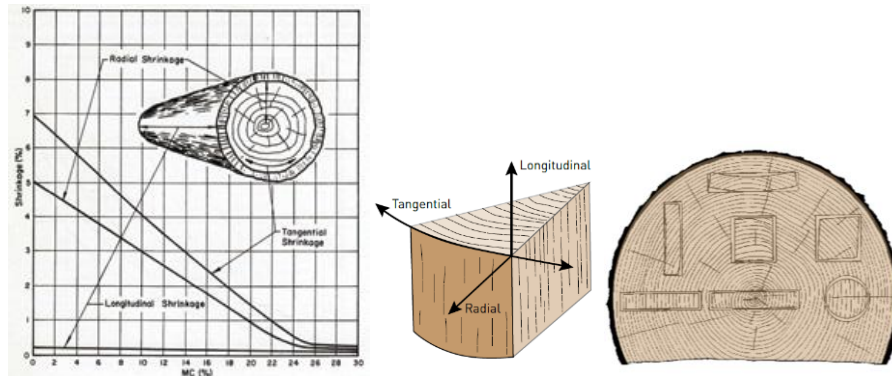


Figure 1. a) Hygroscopic and anisotropic properties of the wood (Kesik & Martin, 2021; Glass & Zelinka, 2010)



Figure 2. CLT and example of deterioration of CLT flooring under the influence of moisture (Kesik & Martin, 2021)

MTPs are exposed to water and moisture from various sources, from manufacture to transport to site and construction to use. Sources of liquid water such as rain, snow/ice melt, and ground moisture during the construction phase, and leaks in the plumbing system during use are typical sources of wetting. The ends of the panels (end grain, face grain), and gaps between the laminations and grooves at the joints present great wetting risks (Figure 3). Panels absorb water vapor from the in a humid environment, also increasing moisture content. When the wood is no longer absorbing or losing moisture, it reaches equilibrium moisture content with the environment (Wang, 2020). As a result of wetting and moisture, staining, fastener corrosion, mold growth, decay, cracking, and surface checking can occur in mass timber elements (Dunn, 2023) (Figure 4). These may affect building aesthetics, structural capacity, and indoor air quality. (Moisture Risk Management Str., 2022)

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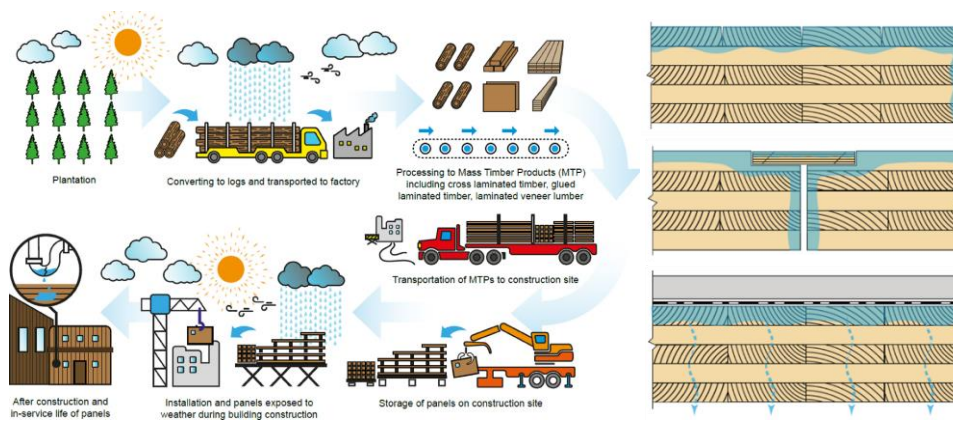


Figure 3. a) Wetting resources (Shirmohammadi, Leggate, & Redman, 2021)
b) Wetting points (Moisture Risk Management Str., 2022)

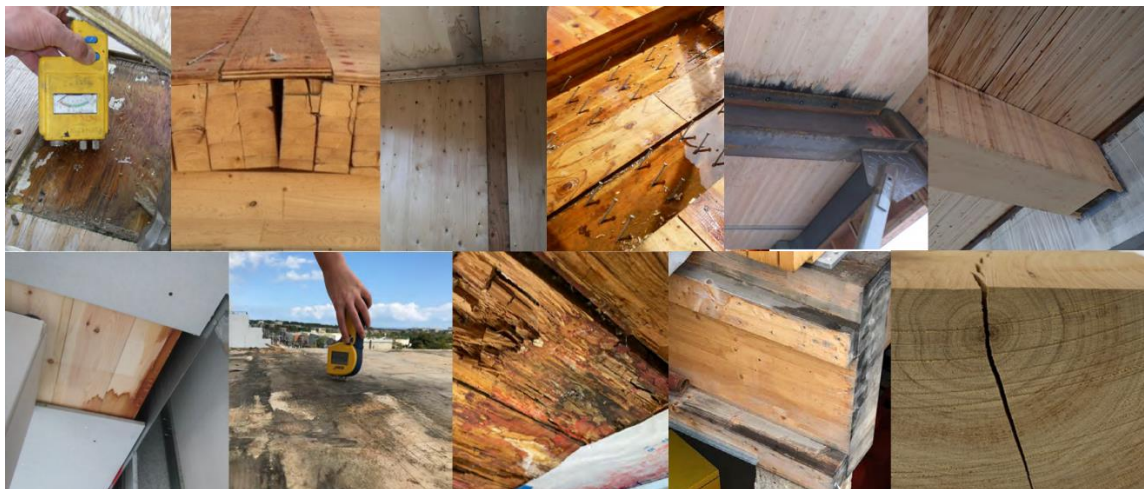


Figure 4. Moisture effects on mass timber panels. (Moisture Risk Management Str., 2022)
(Dunn, 2023)

Cross Laminated timber (CLT), one of the most preferred industrial timber products in modern timber construction, consists of 3-5-7 layers of wood stacked and glued diagonally at 90 degrees and is used as structural system elements in buildings (Figure 5). CLT panels with high strength have low ductility and the ductility of the connections made with metal plates, nails/screws determine the earthquake resistance of the structure (Figure 6). Swelling and shrinkage of the panels due to moisture and corrosion of metal elements affect the structural system and cause deterioration.

Connections are the most exposed parts during the construction phase and will cause damage if not properly designed to resist moisture (Figure 7-8). The panels have a slow drying time due to their high water absorption capacity. If the panels reach equilibrium moisture content naturally or manually drying methods, the swelling and shrinkage from wetting and drying cycles may cause cracks, resulting in significant damage to the panels.

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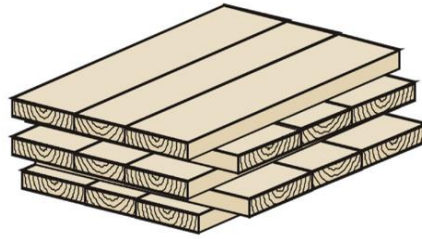


Figure 5. Formation of CLT. (Massive Timber Construction Sys., 2018)

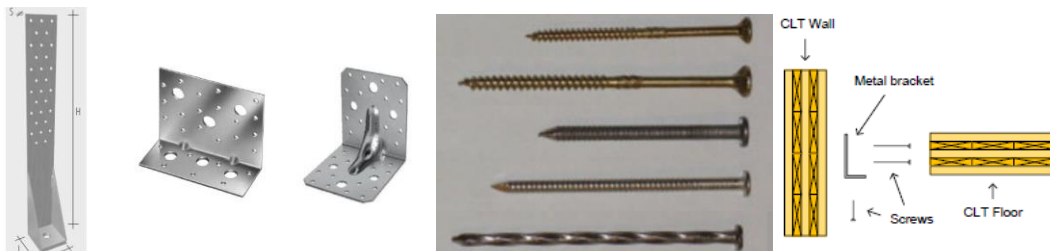


Figure 6. Connection elements. (Karacabeyli & Gagnon, 2019)



Figure 7. Moisture effects on connections during construction. (Kalbe, Kukk & Kalamees, 2020)

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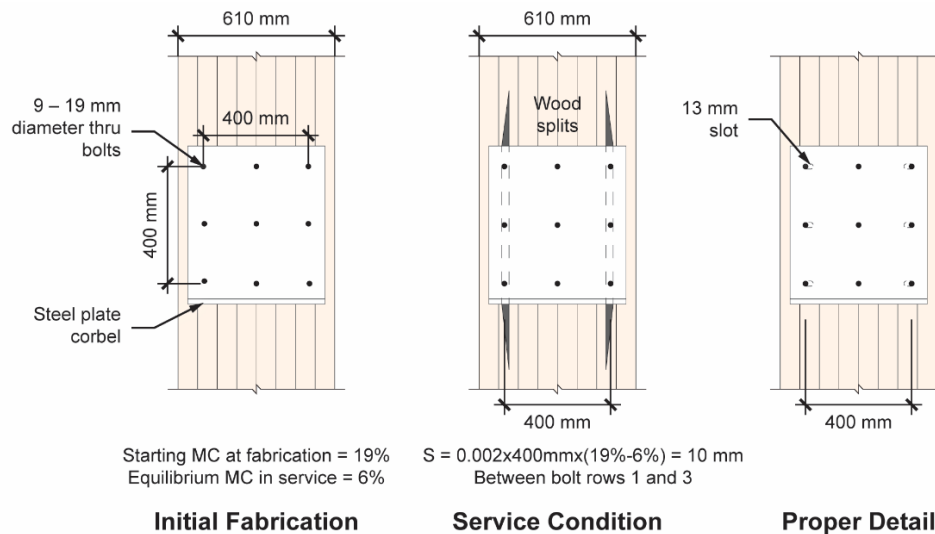


Figure 8. Damage caused by shrinkage (Encapsulated Mass Timber Const., 2021)

2. MATERIALS and METHODS

To investigate the effect of moisture on the strength of CLT, a review of literature, standards and CLT handbooks were examined. There are varying global standards regarding the moisture content of wood, with specific requirements set for determining moisture content (MC) and optimal equilibrium moisture content conditions. According to TRADA (2019), it is advised that the MC of wood used in construction should not exceed 20%, and according to AWC (2018) and APA/ANSI (2018), under dry service conditions, the MC should be less than 16% and approximately $12\% \pm 3$. Although standards specify MC measurement methods, there is no standard test method for the moisture/strength relationship. When reviewing the CLT manuals, while they provide details such as the interaction of the structure during construction and manual protection methods, there is no direct reference to strength. Therefore, an analysis of strength and moisture was conducted through literature studies.

3. FINDINGS FROM EXPERIMENTS and DISCUSSION

The relationship between moisture and strength in structural timber has not been adequately investigated. Tests have been carried out on samples of various sizes under a range of nails and wetting conditions, allowing us to gather data on the application of wetting and water-impregnation techniques based on field data.

In the study by Kalbe et al. (2022) a laboratory set-up was established to observe the moisture distribution in CLT panels, although the durability was not investigated. CLT specimens were placed in the container to ensure they remained immersed in 1-2 mm of water. The transfer of moisture was observed using blue ink added in water (Figure 9&10).

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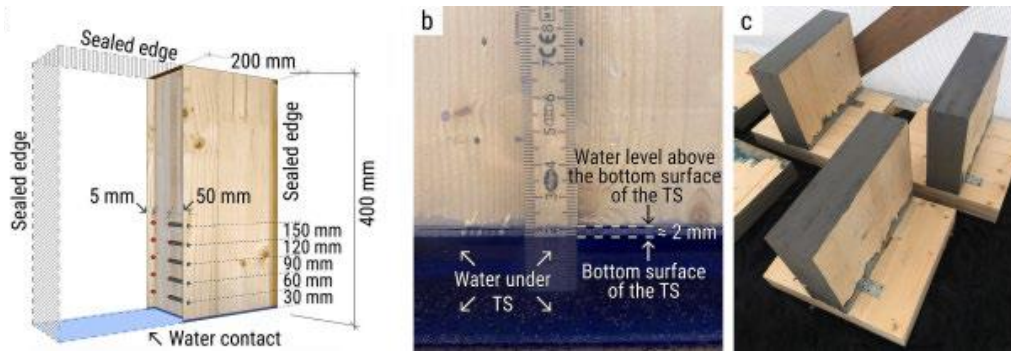


Figure 9. Test setup in the study by (Kalbe et al., 2022)

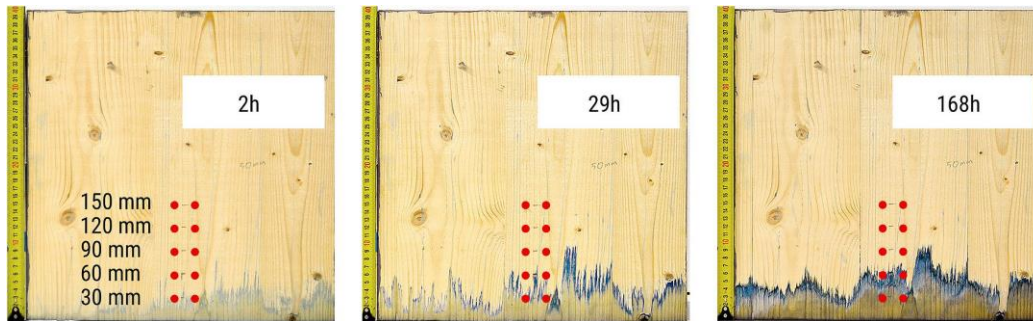


Figure 10. Water rising in panels (Kalbe et al., 2022)

When analyzing the results, end-grain surfaces of CLT panels are susceptible to wetting effects and need to be protected.

Rammer and Winistorfer (2001) conducted a study on the impact of moisture on dowel-bearing strength. Samples were split into two groups: in the first group, Southern Pine specimens were subjected to bolt tests at five different moisture levels (4%, 6%, 12%, 19%, and natural moisture content), in the second group, Southern Pine, Douglas Fir, Spruce-Pine-Fir specimens submitted to flat nail tests at 6% and 20% moisture content.

There is a marked increase in dowel-bearing strength as moisture content (MC) decreases. This correlation remains consistent across multiple types of wood and connection elements (Figure 11).

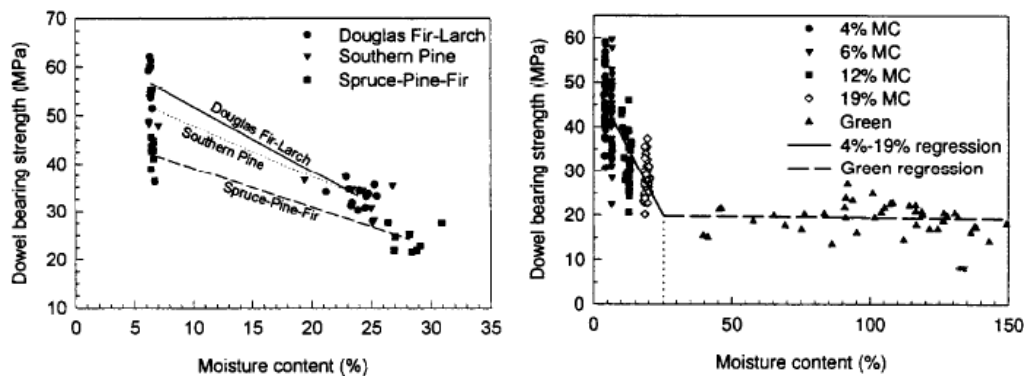


Figure 11. Dowel-bearing strength relation with MC (Rammer & Winistorfer, 2001)

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Ringhofer et al. (2014) investigated the impact of varying moisture content on the withdrawal strength of screws on solid wood and laminated wood (CLT) specimens produced from Norway spruce. The solid wood samples were tested in both the grain and perpendicular the grain directions and samples were exposed 8% 12% and 18% MC and nail withdrawal strength was determined at these moisture levels (Figure 12).

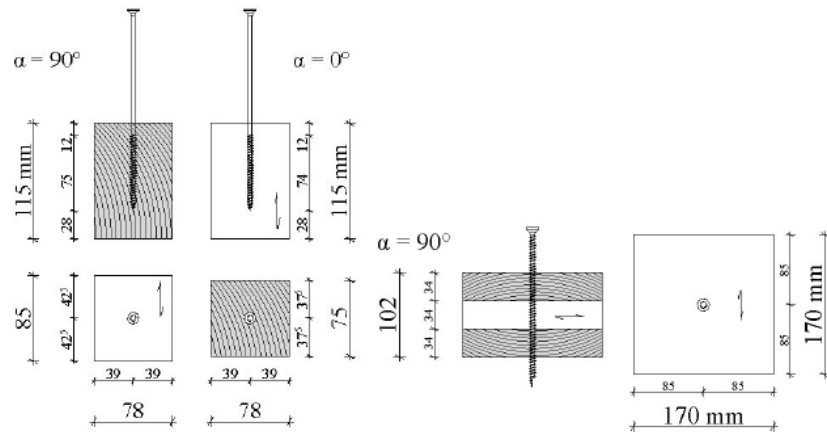


Figure 12. Test setup in the study by (Ringhofer et al., 2014)

Analysis of the results shows that withdrawal strength decreases with increasing MC, especially above %12 moisture content, in both solid and laminated wood samples (Figure 13).

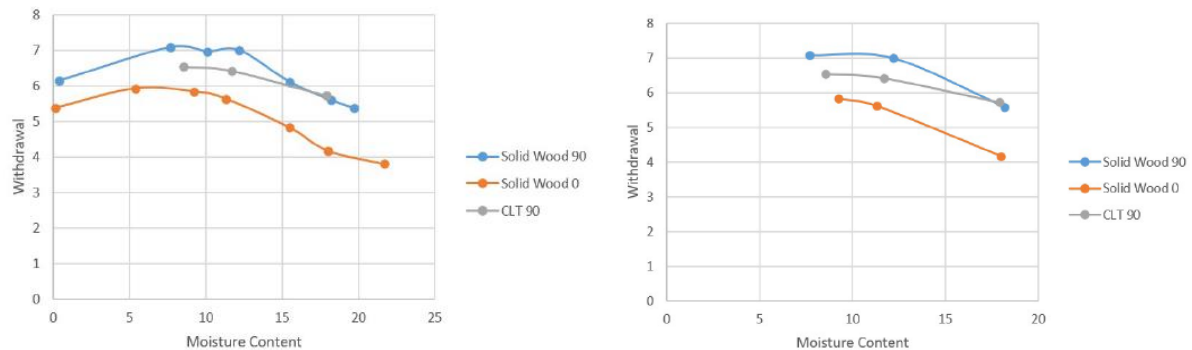


Figure 13. Graphs were prepared based on the results of the study by Ringhofer et al., 2014.

In the first of two similar research, Bora et al. studied the effect of short-term rain on CLT angle brackets. The specimens were sprinkled at an average of 10°C and average relative humidity (RH) of 80%, and dried specimens were returned to pre-test conditions of 10°C and 40% RH (12 ±3%). Following this, they carried out cyclic loading tests on the samples and measured the effects of the humidity (Figure 14).

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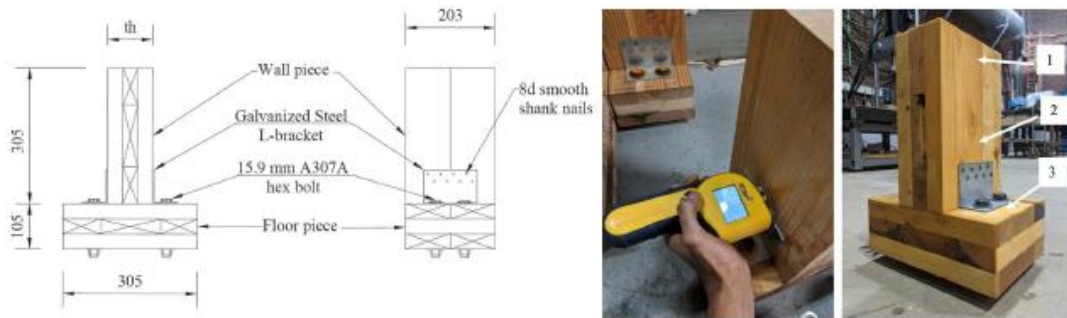


Figure 14. Test setup in the study by (Bora, Sinha & Barbosa, 2022)

In the second study conducted by Bora et al., wetting, and drying tests were performed on connections using identical samples. This study aimed to investigate the exposure as a wetting method.

The findings reveal that separate studies with different soaking cycles and methods using the same specimens are similar. The load-bearing capacity of the wet specimens increased compared to the control specimens. The flat nails used in the experiments caused this effect by swelling. The result of the experimental setup using straight nails is controversial. Additionally, wetting and redrying resulted in a statistically significant decrease in total energy dissipation capacity of the connections (Figure 15).

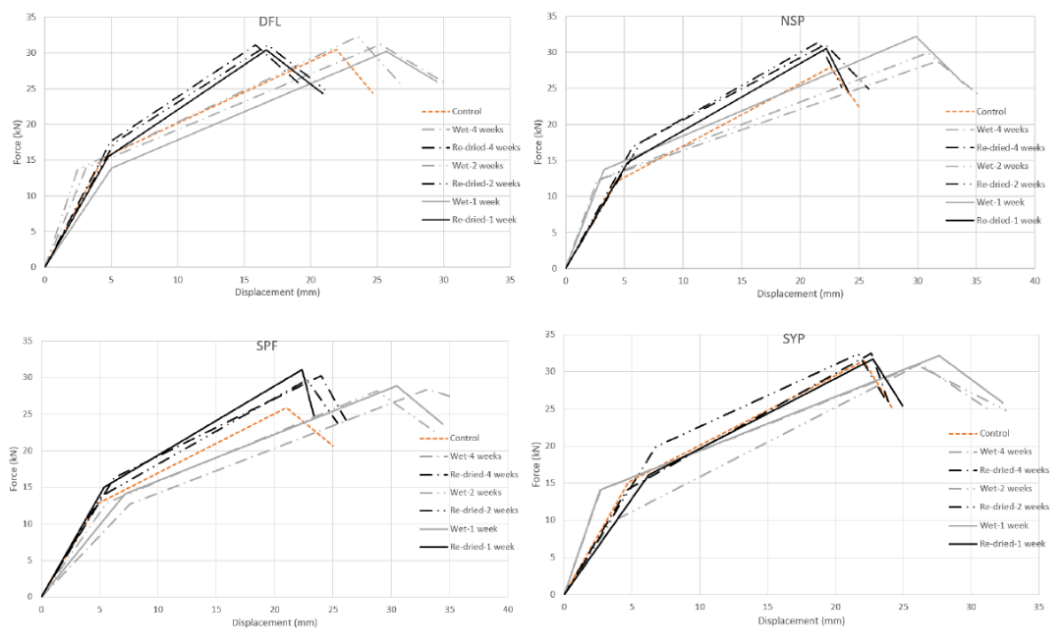


Figure 15. Average ASCE 41-17 trilinear curves of different exposure conditions of the samples prepared data taken from the research by Bora, Sinha & Barbosa, 2021.

The potential corrosion of metal nails and screws typically used in connections with changes in MC is another factor to consider when examining the relationship between moisture and strength.

Yerman et al. (2021) explored the impact of repetitive exposure to moisture on the strength and corrosion of nails in wood. The study used plain and galvanized nails in tests on pine samples.

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The specimens were soaked until they reached 50-60% MC and dried 10-15%MC. Samples underwent 1, 3, 5, and 8 cycles of wetting and drying, followed by conducting withdrawal tests.

After one cycle, there was a decrease followed by an increase after three cycles, and then a steady decrease (Figure 16). Plain nails experienced a more marked decrease than electro-galvanized nails. It is emphasized that using galvanized fasteners in wet conditions is crucial.

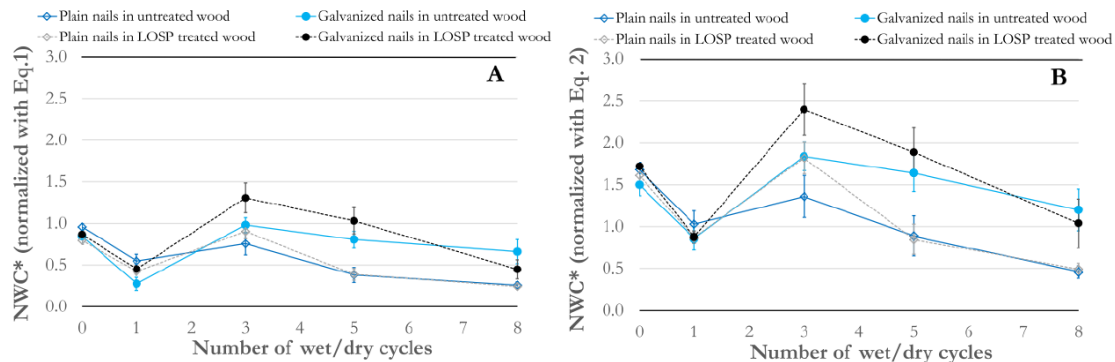


Figure 16. Test results from the study by (Yerman et al., 2021)

4. CONCLUSION and RECOMMENDATIONS

- Moisture ingress can cause decay and microbial growth, impacting the durability of CLT.
- Changes in moisture content within wood can cause changes in dimensions and stress in connections.
- The strength-moisture content relationship is not dependent on species or connection type.
- The effect of moisture hurts the energy dissipation capacity of connections.
- The moisture content of wood has a significant effect on the pull-out resistance of self-tapping screws.
- The moisture content of wood elements markedly affects the withdrawal of screws, especially if the moisture level exceeds 12%.
- Galvanized nails represent higher withdrawal capacity than plain nails.
- The connection elements used in the tests should be preferred to give accurate results.

The effect of moisture on the strength is obvious but should be investigated in more detail and a standard strength/moisture relationship test method should be determined. By knowing the effect of moisture on strength and connections, precautions such as producing CLT construction details designed against moisture, preventing loss of strength, and vulnerability to moisture can be proposed.

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**DOES PUBLIC AGREE ON COASTAL RECLAMATION IN THE SOUTHEAST
BLACK SEA REGION OF TÜRKİYE?**

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ABSTRACT

Over the past few years, the Southeastern Black Sea Region of Turkey has undergone extensive coastal reclamation, resulting in the loss of its natural coastlines. This study aims to assess public perceptions of coastal reclamation practices in the coastal development process of the region. To achieve this objective, a set of questionnaires utilizing a five-level Likert scale was conducted to gauge public opinion regarding coastal development in the region. A total of 432 individuals participated in the survey, with the majority stating that they possessed a moderate to very well understanding of the region's coasts and had been living in the region for over 20 years, thereby witnessing the coastal reclamation process firsthand. The survey results indicated that participants held a negative attitude towards coastal reclamation preferences. In contrast, participants showed positive attitudes toward preserving non-artificial coasts for sustainable coastal natural preservation. In addition, participants agreed that public opinion should be considered in coastal management planning in the region. The reliability analysis of the questionnaire yielded favorable results. The findings of this study suggest that the most common coastal reclamation practices implemented by the local authorities fail to meet public demand. This study underscores the importance of considering ecological and socio-economic aspects in terms of sustainable coastal development.

Keywords: Coastal Area, Coastal Management, Coastal Reclamation, Public Perception, Black Sea.

1. INTRODUCTION

Coastal areas are invaluable regions that provide humanity with resources and vital ecological functions (Barbier et al., 2011; Lakshmi, 2021). These areas, characterized by their unique blend of land and sea, play a pivotal role in sustaining life on our planet. Coastal regions provide benefits for coastal communities ranging from fisheries that feed millions to the recreation and relaxation they provide (Pascoe et al., 2023). The coastal region is also the epicenter of intense anthropogenic activities (Abdelfattah et al., 2023). The dense human population, coupled with industries, tourism, and urbanization, places enormous pressure on these fragile ecosystems (Burak et al., 2004; Zhu et al., 2023). Balancing the utilization of coastal resources with their preservation is a complex challenge that requires sustainable and responsible management to ensure that these vital regions continue to thrive for future generations (Bremer et al., 2022).



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However, human activities in coastal areas have led to coastal ecological and socio-economic degradation, with adverse consequences for both the environment and local communities (Mishra et al., 2021). These detrimental actions, including pollution, overfishing, urban development, and industrial activities, have disrupted the balance of coastal ecosystems (Andrews et al., 2021). As a result, a decline in biodiversity, the loss of critical habitats, and the deterioration of water quality, all of which have far-reaching impacts on the health of oceans and the well-being of coastal communities (Slingenberg et al., 2009). Furthermore, the socioeconomic consequences of these activities are obvious, as coastal populations bear the weight of environmental deterioration. The degradation of coastal ecosystems directly impacts livelihoods, with many dependent on fisheries and tourism seeing declines in income and opportunities (Becken, 2016). Additionally, the vulnerability of these areas to extreme weather events is heightened due to ecosystem degradation, putting lives and property at risk (Lotze et al., 2006; Nichols et al., 2019). For decades, the Black Sea has borne the brunt of numerous detrimental anthropogenic activities that have taken a toll on its delicate ecosystem. These relentless pressures include eutrophication, stemming from excessive nutrient runoff, overfishing that has depleted marine populations, pollution from industrial and urban sources, and the devastating impacts of wars in the region (Altın et al., 2009; Stanev & Ricker, 2019; Ulman et al., 2020). Moreover, the relentless encroachment of land reclamation projects has further altered the coastal landscape, exacerbating the Black Sea's ecological issues (Güneroğlu, 2015). The cumulative effects of these activities have resulted in a profound and long-lasting degradation of this once-thriving body of water. Over the past few decades, the Southeastern Black Sea region has undergone extensive coastal reclamation, resulting in the loss of its natural shorelines (Erüz & Ismail, 2015; Ismail, 2016). Coastal reclamation is a widespread practice in coastal development around the world (AlQahtany et al., 2022; W. Chen et al., 2017). However, these practices often fall short of achieving their main objective, which is to promote human welfare, due to the subsequent ecological degradation (Hossain et al., 2018; Yu et al., 2017). This degradation leads to the loss of social and economic well-being for communities. The relentless progression of coastal development and extensive reclamation projects has engendered a complex web of conflicts surrounding coastal land uses (Hu et al., 2018; Wang et al., 2021). Conflicts over opposing interests escalate as urban growth and infrastructural expansion continue to encroach on coastlines. These conflicts encompass a range of issues, from disputes over limited space for residential and commercial purposes to ecological concerns stemming from habitat destruction and environmental degradation (Y. Chen et al., 2019; Ma et al., 2019; Yu et al., 2017). Addressing these multifaceted conflicts necessitates comprehensive planning, effective governance, and sustainable practices that strike a delicate balance between accommodating the needs of growing populations and safeguarding the fragile coastal ecosystems that are vital to our planet's health and well-being. This study aims to assess public perceptions of coastal reclamation practices in the coastal development of the Southeastern Black Sea Region of Turkey.

The primary objective is to gauge public preferences between natural and artificial coastal environments and to gain insights into public perceptions concerning the ongoing, and often long-term, coastal reclamation practices within the context of regional coastal development. This comprehensive assessment aims to shed light on how the community values the balance between preserving the natural state of coastal areas and embracing man-made alterations and also seeks to understand the public's perspectives on coastal management in the region.

2. MATERIALS and METHODS

Characteristic of the study area

The study area is situated within the Trabzon Province, in the Southeast Black Sea region of Turkey. With a population of approximately 818,023 people as of 2022, according to data from the Turkish Statistical Institute (TÜİK), Trabzon is a dynamic region where the majority (89%) of its residents reside and derive numerous benefits from the region's narrow coastal area and the riverbanks (TÜİK, 2022). This unique blend of natural beauty and human habitation makes Trabzon a fascinating area for study and exploration. Most of Trabzon Province's coastal area has undergone long-term coastal reclamation (Güneroğlu, 2015; Ismail, 2016).

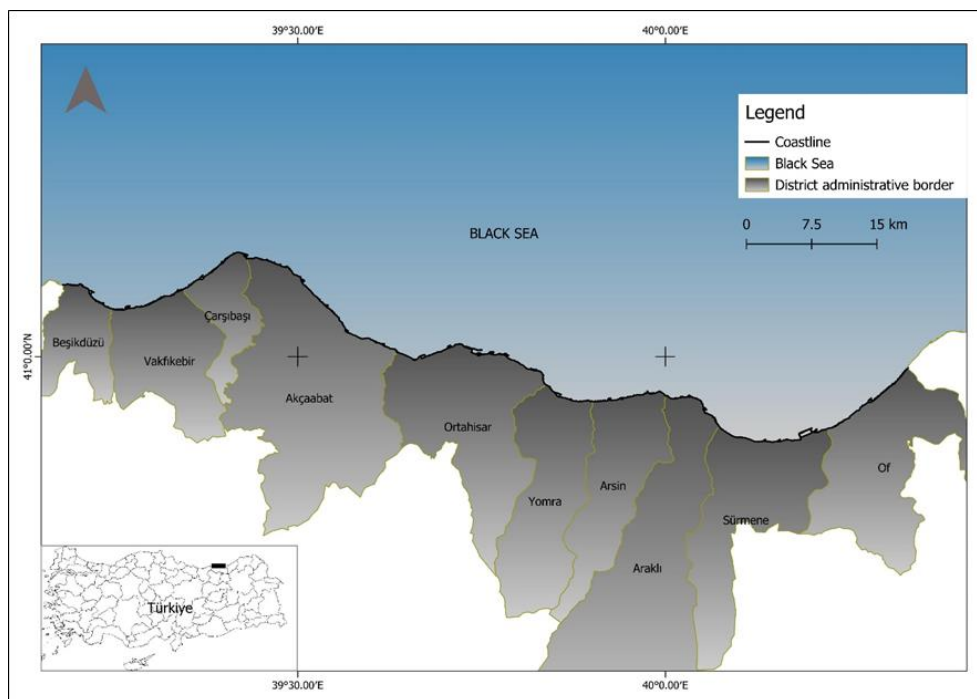


Figure 1. Location of study

Survey methods

Perceptions of people of Trabzon were collected through a public survey. Attention was paid to the fact that the participants of the survey were especially those who benefit from the coastal area and sea in Trabzon also its surroundings. Most participants reside in the Trabzon coastal area (10 districts). To achieve this objective, a series of questionnaires were conducted to gauge public opinion on the topic. The questionnaires utilized a five-point Likert scale: (1 – *Strongly disagree*, 2 – *Disagree*, 3 – *Neutral*, 4 – *Agree*, 5 – *Strongly disagree*).

Data analysis

The questionnaire's reliability was established through a meticulous assessment of its internal consistency using Cronbach's Alpha, demonstrating its trustworthiness as a research instrument. The reliability analysis of the questionnaire yielded favorable results ($\alpha \geq 0.8$). Furthermore, data obtained from the survey underwent rigorous statistical analysis, including the Kolmogorov-Smirnov and Shapiro-Wilk tests, revealing that the data did not conform to a normal distribution. Given this characteristic, a Non-parametric One-Sample Wilcoxon test was

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employed to examine the extent of public consensus on matters related to coastal development and reclamation in the region. All statistical analysis was conducted using the software package SPSS (George & Mallery, 2010).

3. FINDINGS and DISCUSSION

In this study, public perception regarding coastal reclamation practices within the context of coastal area development in the Southeast Black Sea Region of Türkiye has been conducted through a public survey. A total of 432 individuals from Trabzon province participated in the designated survey. The majority of respondents resided in Ortahisar district (Trabzon center) accounting for 62.7% of the total sample, followed by participants from Akçaabat district (20.8%) and Yomra district (4.9%). The remaining respondents (11.6%) were drawn from other coastal towns (districts) within Trabzon Province and areas outside of Trabzon (Figure 2). Ortahisar district (Trabzon center), Akçaabat district, and Yomra district are not only among the most populous districts in Trabzon Province but have also experienced ongoing coastal reclamation as part of coastal development initiatives in recent years (Güneroğlu, 2015; Hamzaoglu & Dihkan, 2023; Ismail, 2016).

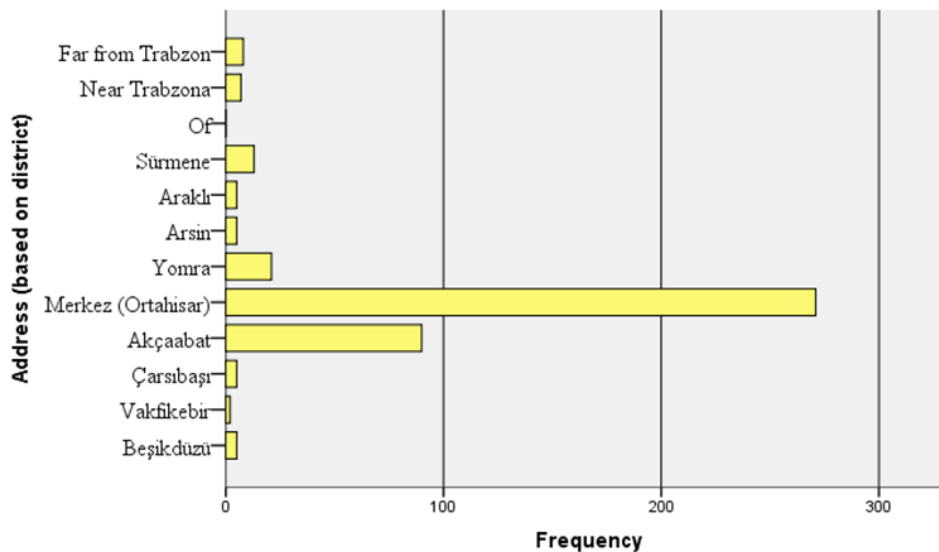


Figure 2. Survey participant's origin (based on the district in Trabzon)

In order to assess public perception regarding coastal reclamation practice in terms of coastal development in the region, we conducted a survey that focused on the duration of respondents' residence in Trabzon Province. The results revealed that a significant majority of survey participants had resided in Trabzon Province for more than two decades, accounting for 78.2% of the total respondents. Additionally, 12% of participants had been living in the province for 10 to 19 years, while 4.9% had resided there for 5 to 9 years. The remaining 4.9% of participants had been in Trabzon Province for less than 5 years. Participants' period of live in Trabzon is shown in Figure 3. The majority of survey participants stated that they had been living in the region for over 20 years, thereby witnessing the coastal reclamation process firsthand. The coastal reclamation process in Trabzon dates back to the 1950's and intensified during the 2000's (Ismail, 2016).



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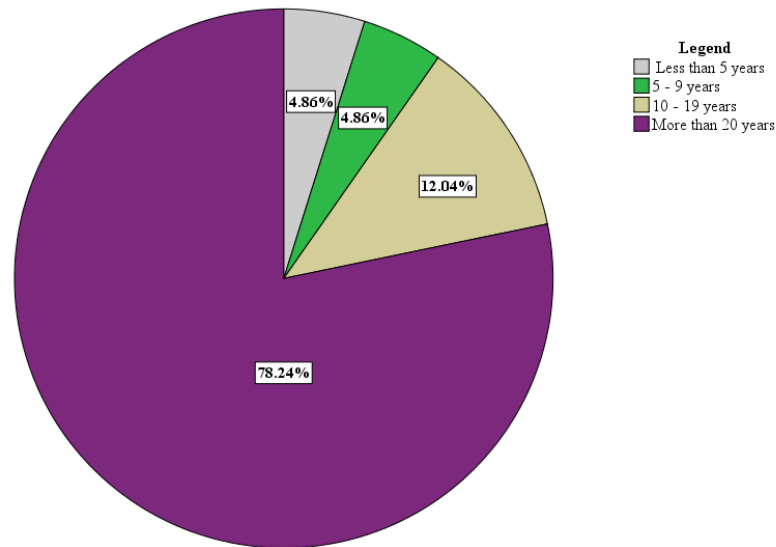


Figure 3. Periods of live in Trabzon

To assess participants' knowledge regarding coastal areas and coastal reclamation/development process in the region, the knowledge of participants was surveyed. The results indicate that only a small number of survey participants expressed very little confidence, with 0.7% ($n = 3$) stating they were "very unconfident," and 3% ($n = 13$) indicating they were "unconfident" regarding their knowledge about the coastal area and coastal reclamation processes in the region. While the majority of participants exhibited a more positive level of knowledge. Specifically, 37.7% ($n = 163$) considered their understanding to be at a "medium/neutral" level, while 33.6% ($n = 145$) reported a "good/confident" level of knowledge. Furthermore, 25% ($n = 108$) of respondents expressed a high degree of confidence, describing their understanding as "very good/confident" regarding the local coastal area and coastal reclamation/development processes. The survey participants' level of knowledge regarding coastal area and coastal reclamation/development process in the region is shown in Figure 4.



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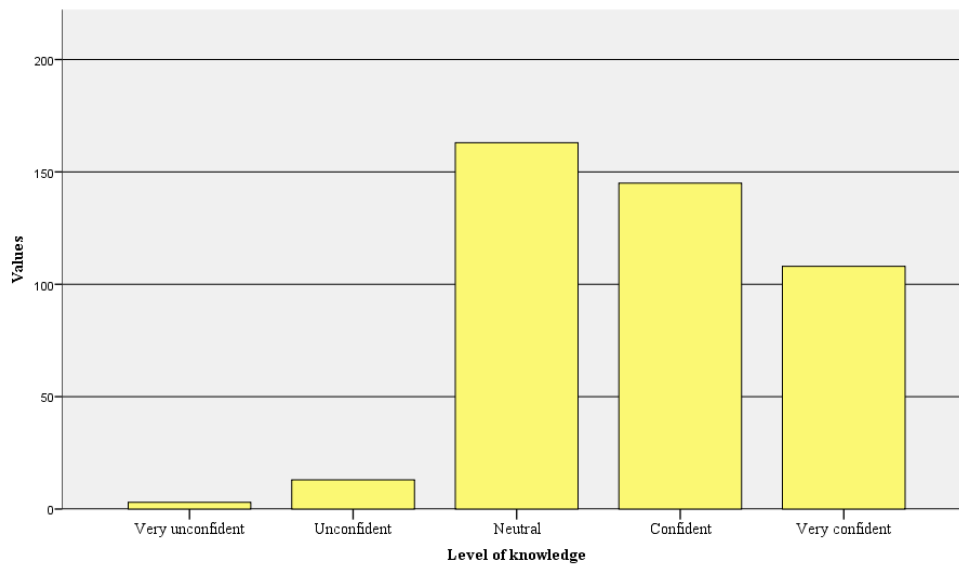


Figure 4. Level of knowledge regarding Trabzon's coastal condition

In this study, public perception of cornering coastal reclamation practice within the context of coastal development in the region was assessed based on participants' attitudes regarding the practices tested using the designated survey. The survey outcomes revealed consistently high mean values in response to the statements that were tested. These elevated mean values reflect the collective perspective of surveyed individuals highlighting the significance of their views regarding coastal reclamation practices in the region. The mean values of statements are shown in Figure 5. The level of agreement on testes surveyed is shown in Figure 6.

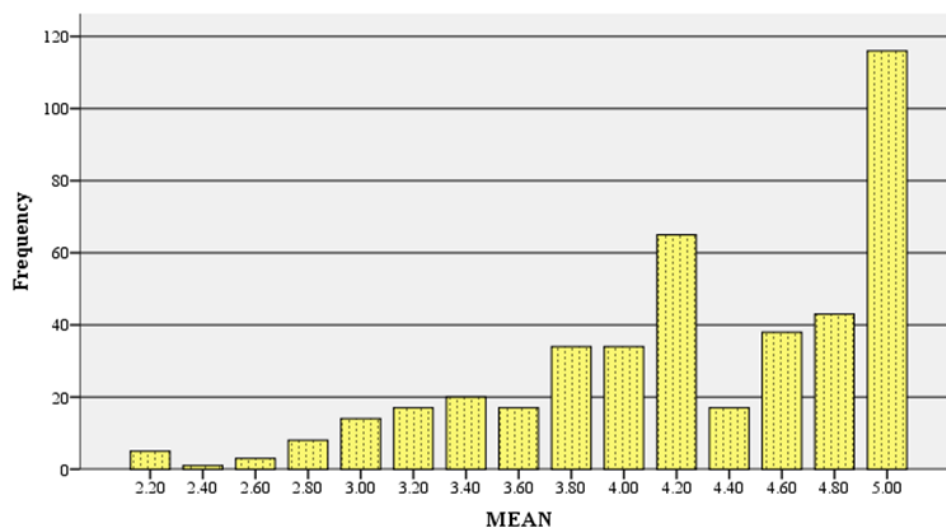


Figure 5. Mean level of participation

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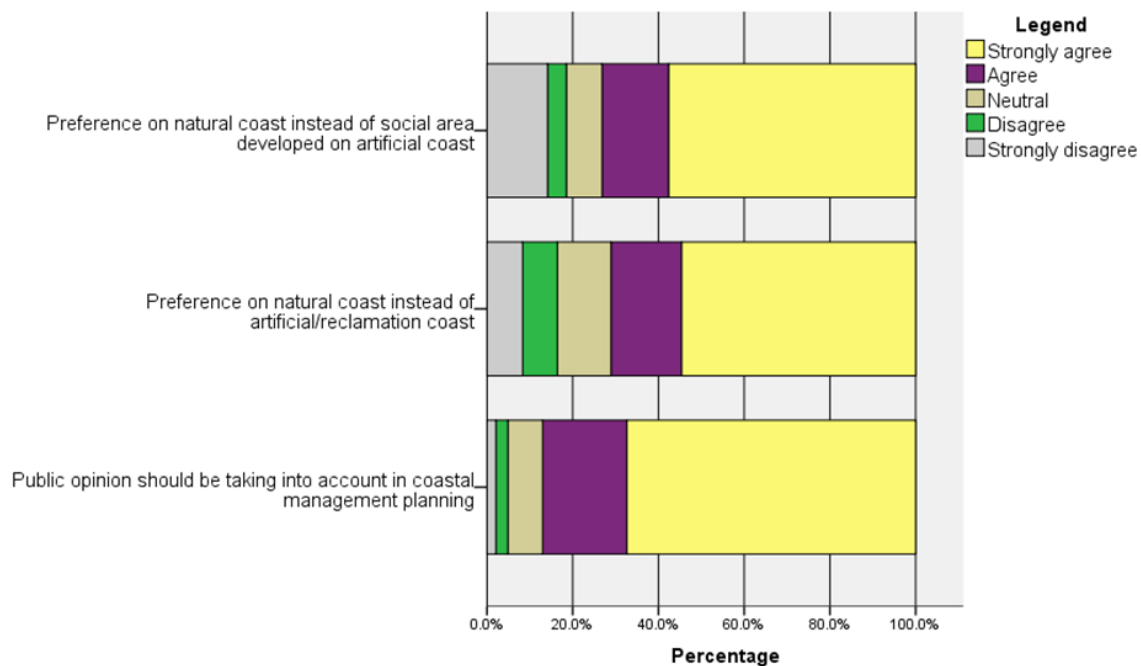


Figure 6. Level of agreement on the statements

The finding derived from a one-sample Wilcoxon signed-rank test unveiled a significant difference in medians, with a Z-score of 15.43 and a $p < 0.01$. This outcome reflects a robust effect size ($r = 0.74$), indicating a substantial magnitude of the observed effect. This outcome suggests that a substantial majority of Trabzon's residents, exceeding 60% of the surveyed population do not support the idea of coastal reclamation or artificial coastal area development. Instead, they have a preference for the preservation of natural coastal areas which signals a prevailing sentiment against these practices in the region. The findings of this study suggest that the prevailing coastal reclamation practices adopted by authorities often fail short of meeting public expectations of preserving natural coastal areas for sustainable coastal area management. This research underscores the importance of considering socio-economic aspects in the concept of sustainable coastal development. The result of this study is several studies conducted in the region. The allure of the old, natural coasts is rooted in the diverse range of beach activities they offer, as highlighted by Alpak et al. (2016). Despite the improved accessibility that new artificial coastlines provide for transportation purposes, the local populace continues to favor the original, natural shores due to the richness of recreational opportunities available. While the initial goal of creating new artificial coasts was to establish social areas, such as parks and sports facilities for the community, research by (Özdemir Işık & Demirel, 2016) indicates that these spaces are primarily limited to seaside activities. Historical remote sensing data and field studies conducted by Güneroğlu (2015) and Ismail (2016) reveal that the reclaimed areas have been utilized for a wide array of social and commercial purposes, including roads, parks, sidewalks, harbors, and seaports. Unfortunately, despite these transformations, the ecosystem services provided by Trabzon's coastal areas have been gradually deteriorating, as observed by Aktürk & Güneroğlu (2021). This highlights the need for a comprehensive approach to coastal management that not only considers the desires of the local population but also prioritizes the preservation and restoration of coastal ecosystems to ensure their long-term health and sustainability.



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4. CONCLUSION and RECOMMENDATIONS

To understand the sentiments regarding coastal development and reclamation in the Southeast Black Sea region of Turkey, a comprehensive public opinion survey was conducted through a public survey. The participants in this survey were individuals who have resided in Trabzon for more than two decades, thereby witnessing the transformation of the once-pristine, natural coastal areas into new, man-made, reclaimed coastal areas along the Trabzon Province. The findings from this survey revealed a striking preference among Trabzon residents, with more than half expressing a strong inclination towards preserving the charm of the original, natural coastlines compared to the newly created artificial and reclaimed coastal areas. This sentiment highlights the deep-rooted connection between the local population and their natural surroundings, underlining the significance of these coastal landscapes to their cultural and environmental heritage. It is clear that while coastal development in the region initially aimed to provide additional social spaces for the local community, a significant portion of the population does not endorse the conversion of the natural coastlines into artificial or reclaimed coastal areas for such purposes. These survey results underscore the importance of sustainable coastal planning and management, where the preservation of natural beauty and ecosystem integrity is carefully balanced with the desire for social and economic development. Based on the principles outlined in the Coastal Law and the recognition that coastal areas are considered common property, it is essential to align coastal management practices with the true intent of serving the public interest and welfare. Based on this outcome, several recommendations can be made to promote sustainable coastal management as follows:

- **Preserve natural coastline:** Sustainable coastal management should focus on protecting the charm and ecological integrity of natural coastlines.
- **Ecosystem conservation:** Sustainable management practices should protect and restore these vital natural resources.
- **Balance development:** Careful planning should ensure that new developments are harmonious with the existing environment.
- **Community engagement:** Locals deep-rooted connection to the coastal landscapes should be acknowledged, and their input should be considered in planning and management.
- **Environmental Impact Assessment (EIA):** EIAs should evaluate potential ecological consequences and consider alternative, less invasive approaches.
- **Integrated Marine Spatial Planning:** Implement integrated coastal management plans that consider ecological, social, and economic factors.
- **Public awareness and education:** Raise awareness among the local population about the importance of sustainable coastal management.

Thanks and Information Note

We would like to thank to Trabzon residents who took the survey.



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**INVESTIGATION OF THE IMPACT OF CONSTRUCTION ACTIVITIES ON
BEACH MARINE LITTER POLLUTION**

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ABSTRACT

This study aims to investigate the impact of human activities, particularly building construction, on beach litter pollution. In this regard, a construction site and coastal areas in the Southeast Black Sea Region of Turkey were selected as the pilot study locations. All anthropogenic litter categorized as macro litter (≥ 2.5 cm) was collected. The collected litter subsequently classified into nine litter groups based on materials (plastic, metal, glass, paper, cloth, wood, rubber, sanitary and medical waste as litter associated with COVID-19). Litter density was calculated to assess the extent of litter pollution in the study area. A total of 1585 litter items were sampled from the construction sites, yielding an average litter density of 2.7 litter items/m². In addition, 730 beach litter items were collected from the beaches, with an average litter density of 1.6 litter items/m². Plastic materials dominated the litter composition in both locations. Foam and hard plastic litter which are frequently used in construction buildings, were widely encountered in significant numbers in both locations. Moreover, a substantial amount of single-use litter items, including plastic bottles, plastic bags, cigarette butts, and beverage containers, emerged as the most abundant litter types in the study areas. These findings underscore the impact of construction waste on marine litter pollution, with the easy transportability of lightweight materials exacerbating the problem. Implementing eco-friendly materials and sustainable construction practices is essential to mitigate the pollution caused by building construction-associated activities.

Keywords: Construction Waste, Architecture, Sustainability, Marine Litter, Marine Pollution, Black Sea.



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1. INTRODUCTION

Coastal regions and riverbanks rank prominently among the most coveted locales for human settlements and are frequently targeted for ambitious construction and development projects for several purposes. These projects include the development of residential communities, public amenities, and the establishment of industrial and commercial zones (Hawa et al., 2023; Yang et al., 2022). The picturesque settings along coasts and riverbanks offer a unique combination of natural beauty and accessibility, making them attractive choices for a variety of development projects (Kurochkina, 2020). Moreover, the accessibility of coastal areas and riverbanks is an invaluable asset for economic, recreational, and logistic purposes. Proximity to waterways facilitates efficient transportation and trade, fostering economic growth and the exchange of goods and ideas in the region (Bax et al., 2022).

The process of construction and building development indicates the transformation of natural landscapes into artificial landscapes (Izakovičová et al., 2021; Simensen, 2018). This transformation is often accomplished through the construction of man-made structures and infrastructure to accommodate the needs and demands of an expanding population as well as a varied range of economic activities (Yu et al., 2017). However, extensive construction and development projects inevitably result in an environmental concern: the substantial accumulation of solid waste within the construction perimeters (Rahman & Esa, 2014). This issue is exacerbated by the widespread use of construction materials that are neither environmentally friendly nor easily recyclable. These materials frequently comprise non-recyclable metals, paper, plastics, and other non-sustainable components, thus magnifying the ecological impacts left by construction activities (Noor et al., 2020).

Significant volumes of solid waste are generated during the construction of buildings. The construction process generates a wide variety of waste, including leftover building materials, demolition debris, packaging materials, and other discarded items (Coşkun & Öztürk, 2012; Kılıç, 2012). Managing and disposing of these solid wastes can pose significant challenges due to their sheer size and weight (Sharma et al., 2020). Thus, it becomes crucial to handle them properly and adopt responsible waste management practices are essential to minimize the environmental impact of construction activities and promote sustainable building practices. Implementing effective recycling and waste reduction measures can play a vital role in alleviating the burden of these weighty and voluminous waste materials on landfills, thereby contributing to a more environmentally conscious construction industry (Wan et al., 2019).

The presence of these waste materials poses a substantial and concerning threat to both the ecological balance of the natural environment and the overall health and safety of human communities (Ankit et al., 2021; Iroegbu et al., 2021). As a result, various proactive measures and comprehensive policies have been put in place to effectively curb the generation of construction waste. These efforts have led to a significant reduction in the associated damage and environmental impact of such waste (Tafesse et al., 2022). Numerous proactive measures and comprehensive policies have been put in place to effectively curb the generation of construction waste, resulting in a significant reduction in their associated damages and environmental impact (Arslan et al., 2012). A study on comparison of such disposal or recycling methods in China shows that greenhouse gas emissions from traditional landfill usage for construction wastes are much higher than recycling of the materials (Liu et al., 2020). Nonetheless, enforcing penalties for non-compliance may encounter multiple challenges,



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prompting an alternative approach that focuses on raising awareness within the sector about the importance of environmental preservation (Kinzig et al., 2013). By cultivating a culture of responsibility and sustainability, the industry can be inspired to adopt voluntary and proactive measures to protect the environment and foster an eco-friendlier approach to construction practices (Yu et al., 2021).

The “Urban Transformation Law” approved by The Ministry of Environment and Urbanization-Department of Waste Management of Turkey, aims to address the issue of structural waste in Turkey. The goal is to significantly reduce the annual production of 45 million tons of structural waste to 10 million tons within the initial three years of its implementation. According to the report presented by the Waste Management Presidency of the Ministry of Environment and Urbanization, this ambitious reduction in structural waste production is expected to be achieved through the effective enforcement of the Urban Transformation Law. As a result, approximately 6 million tons of material will be directed towards recycling efforts (Kılıç, 2012). The significance of this endeavor extends beyond the architectural discipline, as it involves safeguarding the environment, promoting public well-being, and contributing to the overall economy. Recognizing the potential threats posed by structural wastes, the authorities aim to prioritize environmental preservation, public health, and economic sustainability in their waste management strategies (Tafesse et al., 2022).

This study attempts to investigate and conduct a study of the influence of human activities, with a particular focus on construction projects, on the issue of marine litter pollution. The objective of this study is to assess the variety and quantity of solid waste in a specific area, with a parallel aim of enhancing the awareness and sensitivity among architecture students who will play pivotal roles as future decision-makers, designers, and professionals within the construction industry.

2. MATERIALS and METHODS

Study area

To investigate the impact of construction waste and beach marine litter, a construction site in Arhavi and beaches in Sürmene both situated in the Southeast Black Sea Region of Türkiye were selected as pilot study locations. Location of the study area is shown in Figure 7.

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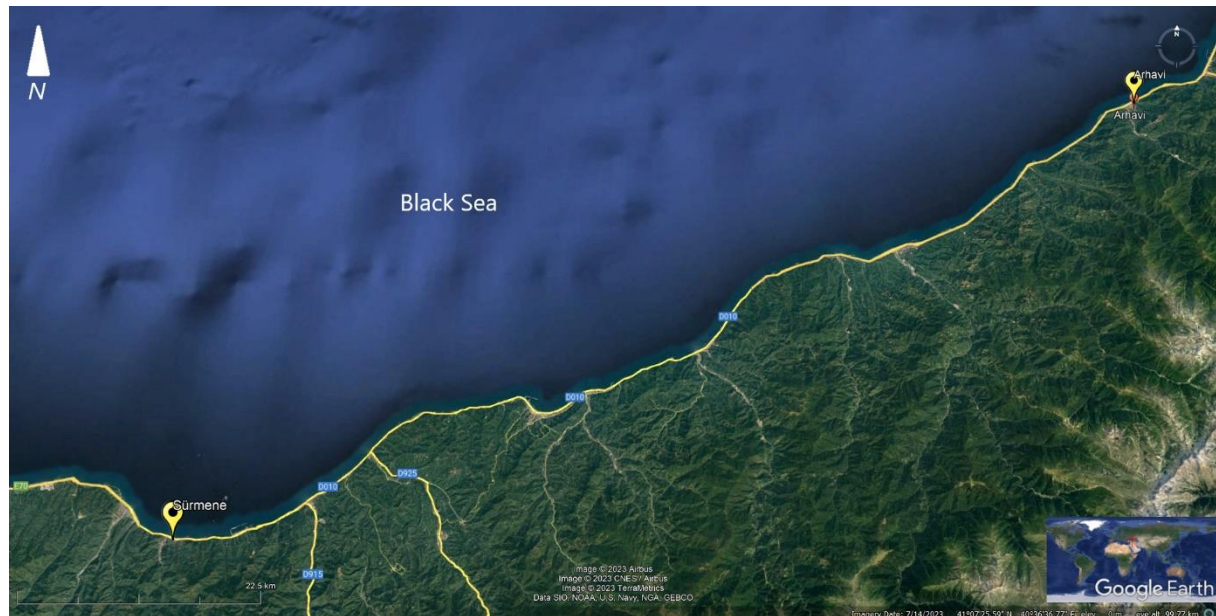


Figure 7. Map of the study area

A field investigation was conducted, specifically targeting areas that were currently undergoing construction activities in Arhavi town. In order to compare construction waste and beach marine litter, samples of beach marine litter were collected from coastal areas in Sürmene town. Coastal areas in Sürmene town were selected as comparisons in this study based on the accountability data and long-term monitoring of beach marine litter which dates back to 2009 (Erüz et al., 2023; Terzi et al., 2020).

In addition, the field study of beach marine litter collection was part of raising public awareness regarding marine litter pollution conducted in both locations in the Southeast Black Sea Region of Türkiye (EU, CBS, BSB-785 LitOUTer Project). This field study was participated by the Art and Design Faculty of Artvin Çoruh University and the Marine Science Faculty of Karadeniz Technical University.

Beach litter collection

In this study, all human-generated litter found within the designated 100-150 square meters transect areas at both sites was collected. The focus of this investigation was on macro litter, and thus, natural debris like seaweed, animal bones, and untreated wood were not included in the litter collection process. By the OSPAR classification system (Aytan et al., 2019; Terzi et al., 2020; Terzi & Seyhan, 2017; Wenneker et al., 2010), the collected litter was categorized into nine primary categories and 42 subcategories, which encompass plastic, rubber, fabric, wood, paper, metal, glass, sanitary waste, and medical waste. In addition, the items associated with the COVID-19 pandemic were classified under the categories of sanitary and medical waste, which included single-use face masks, gloves, wet wipes, bottles for liquid hand sanitizers, packaging for soap, and alcohol-based cologne. To estimate the litter density in terms of quantity (number), the collected items were counted. Sample of construction-related waste in the study area is shown in **Error! Reference source not found.**

Data analysis

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In this study, an assessment was carried out to evaluate the level of litter pollution in the study area. This assessment focused on analyzing the litter's composition, distribution, and density in both sites. To ascertain the litter composition, the percentages of each litter category were calculated relative to the total amount of collected litter. The measurement was expressed as the number of items per square meter (items/m²) (Özşeker et al., 2022; Terzi et al., 2020; Terzi & Seyhan, 2017). For the calculation of litter density, the provided equation (Eq. 1) was employed.

$$D = N/(w * l) \quad (1)$$

The litter density (D) was determined by considering the total number of litter items gathered from the transect (N), the width of the transect (w), and the length of the transect (l), all measured in meters.



Figure 8. Construction-related collected litter on the beaches: hard plastics (PVC pipes and electronic appliances and single-use packages of construction materials)

3. FINDINGS and DISCUSSION

During the Summer of 2022, a comprehensive sampling and collection process was undertaken to collect solid waste from both construction sites and selected coastal areas in the Southeast Black Sea Region of Türkiye. All non-natural litter found along predefined transects was identified and documented to facilitate the subsequent litter categorization process. The collected litter was classified into nine major categories and 42 subcategories according to the OSPAR classification system (Wenneker et al., 2010). Following the categorization procedure, the entire collection of litter from both sites was properly disposed of in garbage containers. This was an essential step in reducing solid waste pollution and protecting the environment. Moreover, this action is part of an effort to raise awareness regarding construction waste pollution and its impact to the environment among architecture students of Artvin Çoruh University and Marine Science Faculty of Karadeniz Technical University actively involved in this study.

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The findings of this investigation revealed that a total of 1585 litter were collected from construction sites while 730 beach marine litter items were collected from the beach sites. The analysis further highlighted plastic materials constituted the most prevalent type of litter, comprising a significant majority of the litter composition at both study sites when evaluated based on item count (number). Following plastic, paper, and metal emerged as the second and third most prominent collected litter in both locations. The litter composition at construction sites was as follows: plastics accounted for 35%, paper for 26%, metals for 24%, cloth for 6%, glass for 4%, wood for 4%, and COVID-19-associated waste for 1% (Figure 9 left). While beach litter composition as follows: plastics accounted for 73%, paper for 20%, metals for 2%, glass for 1%, COVID-19 associated waste (medical and sanitary waste) for 3%, cloth for 1%, (Figure 9 right).

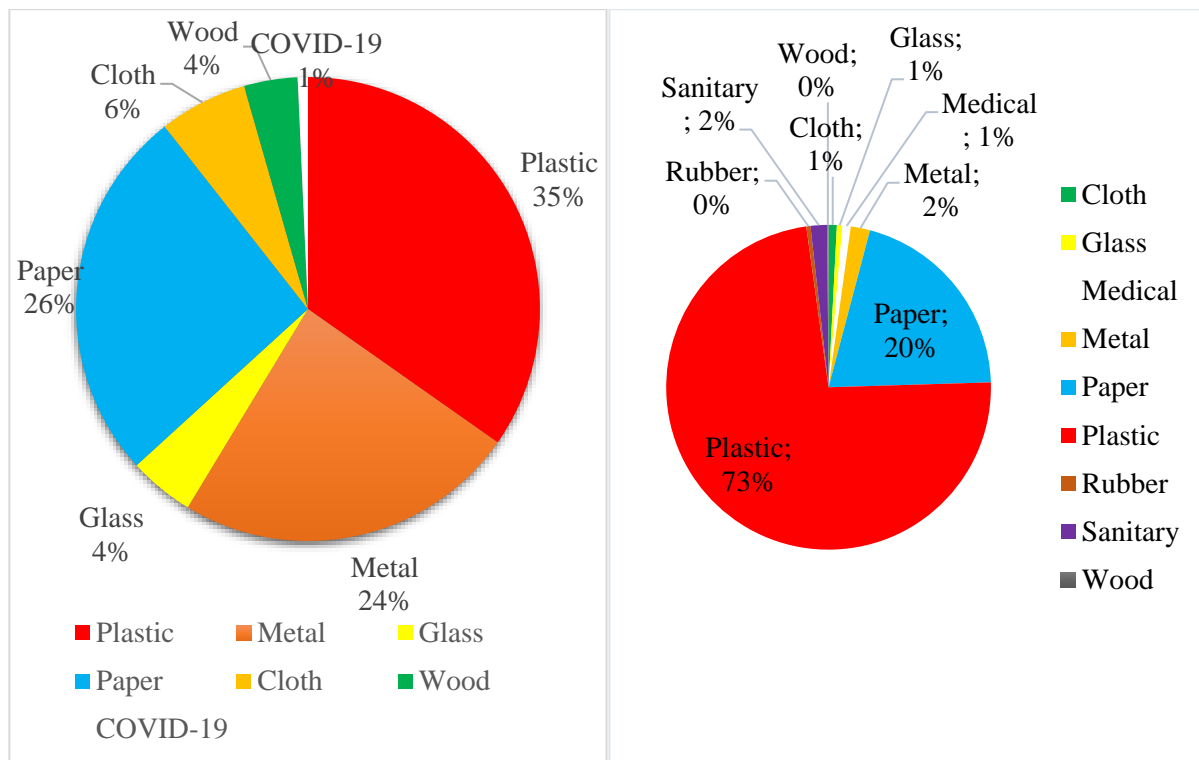


Figure 9. Litter composition from construction sites (left) and beaches (right)

The majority of anthropogenic litter collected from construction sites consisted primarily of plastic, paper, metal, and plastic-mixed materials. These results are in line with the litter collected from coastal areas was predominantly composed of plastic, paper, metal, and plastic-mixed materials. The widespread use of plastics, papers, and metals, which are commonly used in construction either as building materials such as pipes, (styro) foams, cable, etc., or in the packaging of building materials for example faucet furniture or other building materials packaging contributes to their prevalence as construction-related litter. The twenty most common litter in construction sites are shown in Figure 10,

This composition is largely influenced by the significant presence of single-use plastic (SUPs) packaging and items, which contribute significantly to the high amounts of plastics and paper in the litter. These materials, often used for packaging various products and for disposable items, are unfortunately prevalent in coastal litter due to their widespread usage and improper

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disposal practices (Fogt Jacobsen et al., 2022). The substantial presence of plastic materials in this area strongly implies that plastic litter may have accumulated or been transported on sites, possibly carried by run-off, winds, rain, and currents, traveling quite a distance from its initial source before entering the marine environment (Jambeck et al., 2015).

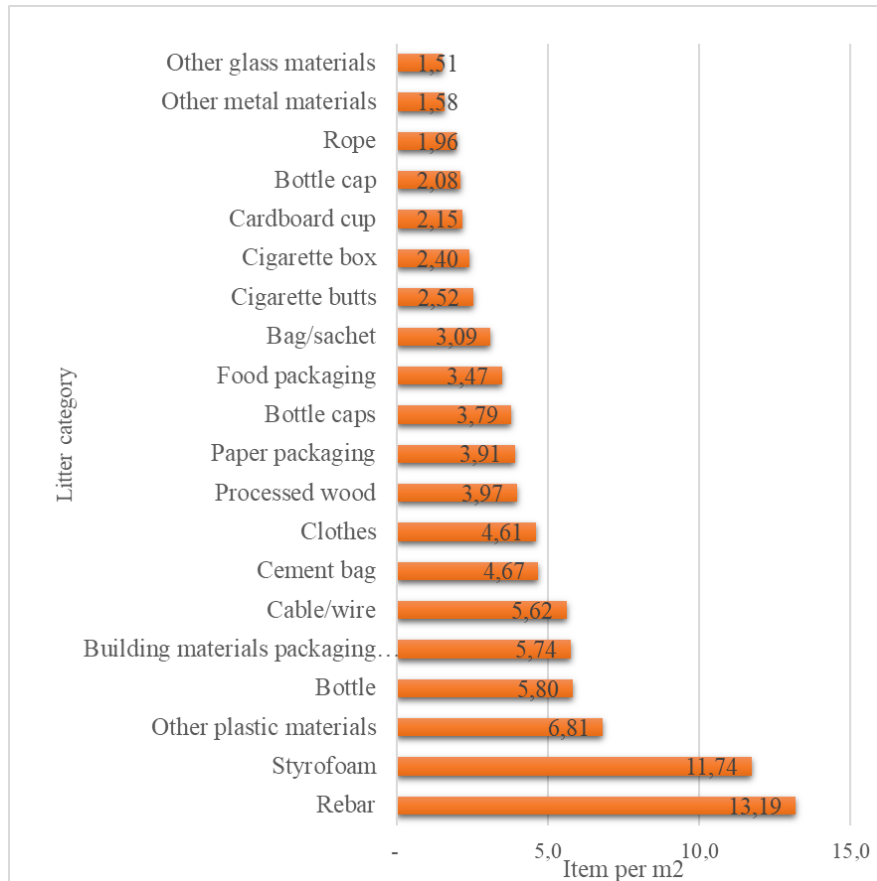


Figure 10. Litter density of most commonly found litter in the construction site

Materials such as plastic, paper, and metal, which are commonly found in single-use plastic (SUP) packaging, food and beverage containers, and similar items, have a noteworthy characteristic—they are lightweight and easily transported from one location to another (Geyer et al., 2017; van Emmerik et al., 2022). Once introduced into the environment, these materials tend to accumulate in marine ecosystems, including beaches, water columns, sediments, and marine organisms. This phenomenon has been well-documented in studies like the one conducted by Bergmann et al. (2015), highlighting the persistence of these materials in marine environments and their potential ecological impacts. This finding indicates a relatively limited level of awareness among people, resulting in litter entering the stream. The collected beach litter is shown in Figure 11. Plastics have gained worldwide recognition as one of the most commonly used and extensively produced materials in the modern era, serving a wide range of purposes. They are extensively employed in packaging, especially for beverages and drinks, which are frequently moved from one location to another. Plastic possesses characteristics such as slow degradation in natural environments and lightweight nature, which make them highly convenient for transportation and contribute to its widespread accumulation. As a result, plastics have become the most prevalent waste material both in terms of quantity and quality.

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Despite their widespread presence, their abundance often goes unnoticed due to their lightweight properties (Barnes et al., 2009; Beaumont et al., 2019; Castro-Jiménez et al., 2019).

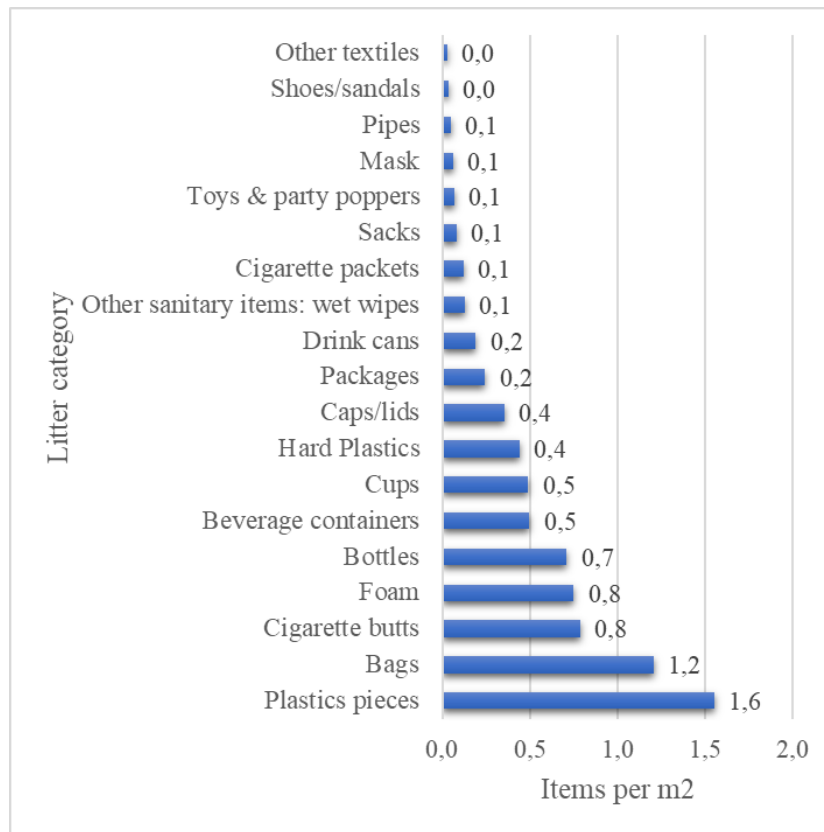


Figure 11. Litter density of most commonly found litter in the coastal sites

The findings shed light on the inadequate waste minimization practices at the construction site, evident in the lack of regular storage for organic debris and solid waste in designated areas, as well as the improper handling of recyclable materials. Consequently, there is a pressing need for architects and engineers, who hold influential roles in decision-making and play active roles in project construction and implementation within the construction sector, to be sensitized to this matter early on, starting from their years as students. They should be encouraged to inquire and proactively seek solutions to key issues, such as "how to reduce waste production," "how to implement effective recycling measures," and "how to minimize the environmental and economic impacts" associated with construction processes. This proactive approach can pave the way for more sustainable and responsible construction practices in the future (Nodehi et al., 2022; Purchase et al., 2022; Yu et al., 2021). While the Regulation on Control of Excavation, Construction, and Demolition Wastes emphasizes the importance of selective demolition, it lacks provisions for recycling and demolition planning (Buzkan & Erman, 2020). Given the oversight of considering the diversity and density of construction waste, there is an urgent call for legal regulations that promote environmental awareness and recycling (Rahman & Esa, 2014; Tafesse et al., 2022).

In an attempt to reduce the usage of disposable plastic bags, Turkey introduced regulations in 2019 that required charges for plastic bags (Çevre ve Şehircilik Bakanlığı, 2019; Dursun, 2020). Similar measures implemented in various parts of the world have yielded promising outcomes,



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resulting in a significant decrease of up to 85% in plastic bag consumption (Cabrera et al., 2021). Nonetheless, despite these regulations, the cost of plastic bags in Turkey remains relatively low, and some merchants continue to distribute them free of charge. This practice could undermine the intended purpose of the regulations and potentially encourage unrestrained and excessive use of plastic bags. Consequently, the persistent issue of plastic waste in the country may worsen due to the continued availability and affordability of single-use plastic bags. To achieve the desired reduction in plastic bag usage and effectively address the plastic waste problem, it will be essential to enforce these regulations more rigorously and educate consumers about the significance of decreasing plastic consumption while adopting reusable alternatives.

These findings underscore the pivotal role of human activities in the accumulation of waste and emphasize the need for heightened awareness and responsible waste management practices among users. They shed light on the pressing requirement to combat overconsumption and improper disposal of single-use plastic products to mitigate the increasing problem of marine litter and protecting the environment. Effectively addressing construction waste and marine litter issues necessitates collaborative efforts from local communities, authorities, and stakeholders to promote sustainable behaviors and reduce dependence on disposable plastic items. The implementation of efficient waste management strategies and the dissemination of awareness regarding the environmental repercussions of beach litter pollution are critical in preserving the clean coastal environment of the Southeast Black Sea region for future generations. By raising awareness and enforcing responsible waste management practices, we can combat beach marine litter pollution and contribute to the long-term ecological well-being and sustainability of the region's coastal areas.

This research is poised to make a substantial contribution to the existing literature, particularly due to the limited number of studies available on the types and quantities of solid waste in construction areas. Furthermore, it is expected to serve as a valuable reference for future investigations into the separation of recoverable pollutants at their source and the promotion of public awareness regarding pollutants and prevention methods, underlining the concept that the environment is a collective responsibility. Additionally, the ongoing support for environmentally friendly construction and zero-waste projects within the framework of the 11th Development Plan aligns with and reinforces the objectives of these studies. It is anticipated that this research will provide a solid foundation for more comprehensive investigations in this field.

4. CONCLUSION and RECOMMENDATIONS

The findings of the study revealed an extensive array of solid waste materials generated from the construction activities, and their quantities were found to be quite substantial within the surveyed area. The findings underscore the significance of responsible waste management practices during construction projects to address the environmental impact and ensure sustainable development in the region. The research findings also revealed a lack of systematic storage for construction solid waste and inadequate mechanisms for recycling reusable materials, leading to the accumulation of waste. Local authorities were observed to have shortcomings in managing waste collection within construction zones, failing to provide essential services. Moreover, despite the legal requirement for inspecting excavation waste from existing structures, there appears to be a deficiency in enforcing this obligation.



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Construction building activities produce a substantial volume of solid waste, with a significant portion of these materials ultimately finding their way into the marine environment, where they accumulate in different parts of the ocean. In light of this situation, the need for innovative and transformative solutions becomes increasingly evident. It is imperative to adopt radical measures aimed at mitigating environmental impacts and transitioning towards the use of eco-friendly construction materials, thereby promoting sustainable development practices. These include:

- Raising awareness among administrators and decision makers and increasing the deterrence of penalties in the laws,
- Architects and engineers, who are project designers, make system design and material selection by considering the amount of waste that may occur in their designs,
- The implementing architects, engineers, or construction site officials should develop solutions to prevent or reuse the wastes generated during the construction phase, implement practices to ensure their recycling,
- In cooperation with local authorities, construction waste is collected, sorted, and recycled into the economy. For example, metals can be recycled, while small pieces of wood can be reused or incinerated.

In addition, through this study conducted in the designated region of Arhavi district within Artvin Province, students majoring in the relevant field gained a heightened awareness regarding the diversity and volume of construction waste. It was evident that the students engaged in fieldwork displayed sensitivity toward the issue.

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**INDUSTRY 4.0 AND THE DESIGN VALUE OF THE PLACE OF 3D PRINTERS IN
FICTIONAL CINEMA SPACES**

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ABSTRACT

In recent years, 3D printers have been used in many industries such as film, television, and advertising. Particularly in the film industry, the use of 3D printers has made the designs of fictional settings, costumes, and characters in movie scenes much more detailed and realistic. Furthermore, the time and repeatability capabilities offered by 3D printers have allowed designers to create complex objects that were previously not possible. These innovations have expanded the boundaries of designers and enabled the realization of designs that were previously impossible. This study focuses on the place and future of 3D printers in the film industry and how they have affected and will affect the design value of fictional setting design. While 3D printers can produce not only simple designs but also more difficult and complex objects, the time and repeatability capabilities offered by 3D printers affect the design and its limitations. Some traditional methods are abandoned due to the innovations brought by the industry, which changes the development and formation of design. The products offered by 3D printers, which are an industrial product, are primarily visual perception objects that reveal the relationship between volume, mass, and structure within a certain space and in a certain form. This study aims to demonstrate the design value of the products offered by 3D printers in fictional cinema settings within the context of the developing Industry 4.0 technology through literature research.

Keywords: Industry 4.0, 3D Printers, Fictional Space, Design.

1. INTRODUCTION

This study examines how 3D printing has redefined design processes and investigates the potential impacts of this technology on the future of society. 3D printers expand the boundaries of design, offering new possibilities in artistic expression and production. Particularly, the film industry is one of the areas that benefit most from the innovations brought by this technology. 3D printers have caused a redefinition of design processes and boundaries by providing designers the opportunity to create complex objects that were unimaginable before. This has facilitated the emergence of detailed, realistic, and extraordinary designs in sectors like cinema, television, and advertising. Additionally, the repeatability and speed brought by 3D printer technology have led to revolutionary changes in the world of design. This technological breakthrough, replacing traditional methods, has accelerated the evolution of design and



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emerged as a part of Industry 4.0. In this study, the changes created in the realm of 3D printing have been examined, and how 3D printing may play a role in societal transformation in the vision of Society 5.0 has been investigated concerning its potential impacts.

Industry, Industry 4.0

Industry, in general, represents a broad economic sector that processes raw materials into manufactured goods and services. Historically, the industry has undergone several major evolutions, and each evolution has led to significant changes in production methodologies, business models, and the economy. Industry 4.0 represents the fourth evolution of the industry and is often referred to as the "Fourth Industrial Revolution."

According to the definition by the Turkish Language Association, industry is expressed through the following sentences by Necati Cumalı: "A novel is a commodity pushed into consumption by the press industry." As can be understood from here, the object to be used, in terms of its position, space, and time, holds value and meaning within the concept of industry. While a novel can be classified as a work of art or literary work in terms of content, it bears the quality of a commodity when evaluated for consumption within the press industry.

Throughout history in the industry, three main revolutions have occurred, namely mechanization, mass production, and digitization. The first industrial revolution (Industry 1.0) triggered a change in production by enabling mechanization through the discovery of water and steam power. Before this revolution, production was almost entirely dependent on human power, but post-revolution, machines began to form the foundation of production. The spread of electricity usage sparked the second industrial revolution (Industry 2.0). Machines that emerged and became widespread during the first industrial revolution gained the ability to operate with electrical energy in the second industrial revolution. Thus, the concept of mass production replaced the old production methods imbued with art and craftsmanship. With mass production, a large number of products can be produced in a much shorter time compared to before. The third industrial revolution (Industry 3.0) occurred with the inclusion of electronic systems and information technologies in production. Along with this revolution, new generation machines and equipment have been developed, and automation has gained importance in production. The fourth industrial revolution, also known as Industry 4.0, has entered our lives along with concepts like robotics, 3D (three-dimensional) printers, advancements in nanotechnologies, and the Internet of Things (IoT). 3D printers are of vital importance for Industry 4.0 due to their potential. It has become possible to produce parts that could not be produced with traditional manufacturing methods using 3D printers, and devices conducive to digital production, which traditional manufacturing equipment cannot possess, have been developed (Yuran & Yavuz, 2021). The occurrences of mechanization, mass production, and digitization have shaped the design process, developing different production possibilities in design through CAD systems and different design production techniques. This has facilitated the development and shaping of every area where design is implemented.

3D Printer and Design Possibilities

Industry 4.0, as the fourth evolution of the industry, represents an era dominated by interconnected systems that automate production processes and are equipped with technologies like machine learning and artificial intelligence. Within this evolution, 3D printers also hold a key role. And 3D printers are far beyond printing technology.



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3D Printers (3B), as sub-components of the Industry 4.0 process, epitomize the point technology has reached. Allowing for the production of a desired product or form in three dimensions, 3D printers have spread to cover nearly all sectors today. Particularly in the manufacturing sector, various new expansions are taking place in the Industry 4.0 process. In this regard, 3D printers possess numerous advantages such as increased speed in production, reduced costs, and minimized pre-production risks (Mayda, 2019).

The concept of constructing a structure using robotic technologies and minimal human labor was known as a distant idea until recently. The applicability of three-dimensional printers required high costs and was quite expensive. This idea has now lost its validity; on the contrary, today, the construction of architectural structures using three-dimensional printers is emerging as cheap, economical, and environmentally friendly (Tümer, 2020). Its impact on costs has further solidified its place in the industry, taking its place within evolving systems. These processes are transforming the nature of trade, allowing for new models to emerge in the producer-consumer balance (Mayda, 2019).

In its simplest form, a three-dimensional printer is a device that enables the conversion of data stored in a computer environment into physical real objects. This technology, at the same time, is capable of producing geometries that cannot be obtained with traditional manufacturing methods (Şahin, Turan 2018). This situation further expands the design boundaries.

Three-dimensional printers are devices capable of producing models that have been modeled on a computer or scanned in three dimensions at a much faster rate compared to traditional manufacturing methods (Fındık & Taşdemir, 2020). 3D printers deviate from traditional manufacturing methods by allowing the printing of high-resolution organic structures. While having each layer of the design in different geometry is an undesirable situation in traditional manufacturing methods, it becomes a feature enabling production in 3D printer technologies. "The Terra Stool" structure, designed by Marco Mattia Cristofori, has been produced as a single piece, without needing any additional support material, and with angles not exceeding 60 degrees, taking into account bionic design principles. In linear designs, right angles pose a problem in accommodating the applied load, while the ability of 3D technology to allow curved angles is a significant feature that will facilitate its faster inclusion among the production technologies of the future (Canbolat & Aydın, 2019). Being produced as a single piece and allowing curved angles enable the use of 3D printers in many areas.

The technology of 3D printing has undergone significant evolution over recent years through two main structures, namely prototyping and production distribution. The three-dimensional outputs provided by this technology are utilized across many disciplines including engineering, architectural design, industrial design, automotive, aerospace, military applications, and the healthcare industry (Balcıoğlu, 2014). Architectural design is one of these disciplines and a deep interaction is observed when the contribution of 3D printing technology to this field is examined. Architectural design processes have become faster, more flexible, and innovative with the contributions of 3D printing technology. 3D printers provide designers with the opportunity to create prototypes quickly and test these prototypes. This facilitates the identification of errors in the initial stages of design and, when necessary, easy modification of the design. Thus, it becomes possible to progress the design process in a more efficient and error-free manner. On the other hand, the use of 3D printers for fictional cinema spaces allows for these spaces to be designed in a more realistic and detailed manner. In the cinema industry,



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especially in science fiction and fantasy films, detailed models and set pieces produced with 3D printers offer a more immersive experience to the audience. The design value of architectural design and fictional cinema spaces within the industry has increased with the contributions of 3D printing technology. This technology allows for architectural designs to become more functional and aesthetic, as well as for the creation of more realistic and impressive spaces in the cinema industry. Therefore, the value added by 3D printing technology to these fields is increasing both aesthetically and functionally. When going through a production and design process with a 3D printer, what becomes the design value of spatial design within the fictional cinema industry?

3d Printers and Fictional Cinema Spaces

The use of 3D printers in creating fictional cinema spaces has brought a new perspective to the film industry. With traditional methods, creating detailed set designs and accessories is both time-consuming and costly. However, the technological advancements brought by 3D printers have made these processes faster, more flexible, and cost-effective.

One of the main principles of Industry 4.0, "real-time" production, manifests itself in fictional cinema spaces through 3D printing technology as well. A set piece that is damaged or missing during filming can be reprinted quickly, which shortens the production time of the film and reduces costs. Furthermore, personalization and customization, another significant feature of Industry 4.0, have become possible in fictional cinema spaces with 3D printing. Special designs or customized set pieces that conform to the requirements of a period can be easily produced thanks to 3D printers. (URL-4, 2022). In conclusion, the use of 3D printers in creating fictional cinema spaces is an excellent example of how the technological innovations provided by Industry 4.0 have been integrated into the film industry. This integration offers a higher level of customization, flexibility, and efficiency in set design and accessory production.

Table 2: Comparison of Modern and Traditional Methods (created by authors)

	Spaces Produced with Traditional Design Method	Spaces Designed with Three-Dimensional Printers
Design Process	The design team creates designs on paper. Initial sketches and concepts are formed.	The design team creates a detailed model using computer-aided design (CAD) software. This model is directly readable by the three-dimensional printer.
Level of Detail	Designs created using traditional methods can be limited in terms of details. Especially for complex structures, manually processing these details can be time-consuming.	3D printers can easily produce complex details. This allows the design to be more realistic and detailed.
Production Time	After the design is completed, the construction process begins. Workers need to cut, assemble, and paint the materials. This process can take months.	3D printers can rapidly produce a physical model of the design. The production time may be limited to days or weeks.



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Iterations	With traditional methods, modifying Design changes can be easily made with or correcting the design can be three-dimensional printers. Reprinting or challenging. Mistakes or design correcting a part can be quick and cost-effective. changes can be costly and time-consuming.
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As in all design models, the source in industrial design is humans; more precisely, it is the concept that is a thinking entity of humans. It is the materialization of the design concept in an object. There is no intrinsic difference among these empirical objects we call design entities. The difference emerges in their value entity. This value entity is based on its ontological structure. (Tunalı, 2009).

2. METHOD

This study delves into how the technology of 3D printers, emerging as a product of Industry 4.0, could facilitate a more comprehensive understanding of the transition to Industry 5.0. 3D printers symbolize the convergence of technological and societal innovations, making them a central component of Industry 5.0. Industry 5.0 emphasizes collaboration between humans and machines; hence, a significant role is anticipated for 3D printers in this era.

3. FINDINGS and DISCUSSION

The aim of Industry 5.0 is to integrate the technological innovations brought about by Industry 4.0 in the most efficient manner, striving to create a human-centered society.

Society 5.0 provides guidance for adapting to the digital transformation era and the fourth industrial revolution on both individual and societal levels. In a study prepared by the Japan Business Federation Keidanren, the objectives of Society 5.0 include;

- Bringing together the virtual world and the real world,
- Benefiting from the Internet of Things while considering the interests of society. (URL-1, 2023)

In the scope of Industry 4.0 and Industry 5.0, we can examine fictional cinema spaces in light of the described aspects.

We can say that the movie Avatar is a milestone in the 3D output stage. With Avatar, the concept of 3D output created has now become one of the indispensable equipment of movies. Throughout the movie Avatar, 3D output has been done many times. The most striking of these are the models made for spaces. (Balcioglu, 2014)

Table 3: Avatar Film, Comparing the Design Value of Fictional Cinema Spaces in the Context of Industry 4.0 and Industry 5.0 (created by authors)

INDUSTRY 4.0

Technological Revolution	Optimization and Efficiency
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"Avatar" emerged in the cinema industry as a result Thanks to 3-dimensional outputs, the scenes in the of technological advancement and digitization. The film were designed, tested, and implemented more film showcased the potential of cyber-physical quickly and efficiently. systems, real-time data analysis, and automation in



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the art of cinema. 3-dimensional outputs were used in creating prototypes of spaces in the film, enriching the details, and designing the physical existences of characters.

INDUSTRY 5.0

Convergence of Art and Technology	Social Values
"Avatar" showcases how technology can integrate with art and create societal impact. The film merges technological advancement with storytelling and visual arts.	The 3-dimensional output experience offered by "Avatar" provided the audience an opportunity to reflect on the relationship between nature, sustainability, and humanity. This is in line with Society 5.0's goal of enhancing societal values and quality of life

Gilles-Alexandre Deschaud, a 3D designer and filmmaker, is known for his short film "Chase Me," in which all characters and accessories are 3D printed. To create the entire universe of this short film, 2500 pieces were 3D printed. Film producer Gilles-Alexandre Deschaud spent 2 years 3D printing all the necessary parts for this film. The reason for using 3D printing is to make all the parts suitable for the atmosphere of the film. Therefore, he was able to independently design 3D objects and the entire universe of "Chase Me" (Url-2, 2023). Allowing him to independently design eliminated the limitations in terms of the layout of the fictional space to be created.

Table 4: Chase me Film, Comparing the Design Value of Fictional Cinema Spaces in the Context of Industry 4.0 and Industry 5.0 (created by authors)

INDUSTRY 4.0

Digitalization and Automation in Manufacturing	Flexibility and Personalization
The use of 3D printing in Gilles-Alexandre Deschaud's film "Chase Me" epitomizes the concepts of digitalization and automation in Industry 4.0. The producer, by embracing 3D printing technology instead of traditional filmmaking methods, digitized the production process and, as a result, achieved both time and cost savings.	3D printing offers the advantages of flexibility and personalization in the production of specially designed parts for the film. Making such detailed and customized production through traditional methods is both time-consuming and costly.

INDUSTRY 5.0

Integration of Technology and Creativity	Empowering Individual Talents and Entrepreneurship
The film "Chase Me" demonstrates how technology can come together with artistic creativity. This film example concretely illustrates how technology in Society 5.0 can support and empower individual creativity.	As stated in the film, Deschaud independently designed all the 3D objects and the film universe. This represents an individual's ability to independently realize large projects thanks to access to technological tools. Society 5.0 aims to create a structure that encourages individual abilities and entrepreneurship



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Award-winning and highly popular films such as Avatar, Iron Man, Star Wars: The Force Awakens, and Black Panther have utilized 3D printing for designing scenes, sets, various components, and more (URL-3, 2022).

Table 5: Iron man, Star wars etc., Comparing the Design Value of Fictional Cinema Spaces in the Context of Industry 4.0 and Industry 5.0 (created by authors)

INDUSTRY 4.0

Flexible Production	Rapid Innovation
3D printing opens the door to customized production, allowing for the rapid and effective manufacturing of custom parts or accessories for a film.	3D printing accelerates the prototyping process, enabling filmmakers to bring their creative ideas to life more quickly.

INDUSTRY 5.0

Sustainability and Efficiency	Personalized Solutions
Society 5.0 emphasizes the more efficient use of resources. 3D printing supports this principle by minimizing material waste.	Society 5.0 places an emphasis on providing solutions that align with individuals' needs and expectations. 3D printing facilitates meeting this need by making it easier to add personalized details to characters, scenes, or objects in films

In the world of cinema, 3D printing first enables the creation of prototypes or the printing of several different versions, allowing for comparison. This provides greater flexibility. If a piece breaks during shooting, it can be quickly reprinted. Additionally, with a simple change, a piece can be designed for an actor without them trying it on first; there is no need to adjust it based on their dimensions before production. Since some 3D printers are relatively easy to transport, production can be done on-site, avoiding long and costly scene deliveries (Url-3, 2023).

It demonstrates how Industry 5.0 highlights the importance of collaboration between humans and machines. While 3D printing serves as a tool that helps filmmakers turn their dreams into reality, computer graphics allow humans to express their creativity and imagination limitlessly. This shows that technology is not just a tool but also an extension of creativity and imagination.

4. CONCLUSION

In conclusion, the concepts of Industry 4.0 and Society 5.0 have a significant impact on the world of cinema, both in terms of production processes and content. The role of 3D printing in the design value of mass production goes beyond individuality or mere industrial production. Its place in the context of production creates a holistic meaning and value within the accepted societal framework of fictional cinema spaces, characters, narratives, settings, and many design elements. It forms a design value within a societal framework rather than individuality, as it is based on a shared appreciation within society.

This is because, as Tunali (2009) expressed, in all design models, including industrial design, the primary resource is humanity, or more precisely, the conceptual existence of human thought.



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ANALYZING THE EXISTING LEGISLATION IN TERMS OF PLANNING AND DESIGN OF SCHOOL SPACES OF THE MINISTRY OF NATIONAL EDUCATION

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ABSTRACT

Education is a process of gaining knowledge, skills, attitudes, values, responsibilities, and habits in terms of cognitive, social, affective, and physical aspects for the individual and society, self-realization of the individual, creating unique learning structures, analytical thinking, and transformation into action and awareness raising. Education is a fundamental human right and an indispensable tool for the realization of other human rights. It also requires the provision of quality basic education services to every individual. In addition to being the places where education will be received and information transfer will be provided, school spaces provide the opportunity to raise self-confident, intellectual, and right-thinking individuals who are culturally and physically adequately equipped, who are effective in the development of students' identity and personality and the progress of their social and cultural relations. It also plays an important role in improving the quality of education and creating added value. The physical environment and conditions of the school are among the most important factors that have a multifaceted effect on the students and service providers. Today, school spaces are shaped and implemented within the framework of existing legal regulations (especially the Ministry of National Education Minimum Design Standards Guide for Educational Buildings issued in 2015). In today's process, especially the association of issues such as the pandemic, food crisis, climate change adaptation process, carbon footprint, technology, and digitalism with school spaces requires to be addressed in the dimension of discourse and action. In this study, the legal dimensions of school spaces affiliated with the Ministry of National Education are discussed current problems are discussed and suggestions are made to adapt to today's conditions.

Keywords: School Spaces, MNE, Legislation, Landscape Spaces, School Gardens.

1. INTRODUCTION

Education is all the work that aims to develop a person's mind, body, emotional and social abilities, and behaviors in the desired direction or to provide him/her with new abilities, behaviors, and knowledge for certain purposes (Kol, 2003).

The realization of both the right to education and other human rights through education requires the provision of qualified basic education services to every individual. The learning environment, environment, learning areas, and their infrastructure, materials, and technology are important in educating students qualified in every aspect. Today considering that the level



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of civilization of a nation is measured by the educational opportunities provided to the children of that nation, the value given to their children, and the effort spent to make children social beings, child education has a very important place (Havayıoğlu, 2001).

Primary and secondary education is responsible for ensuring that the child receives a good education, acquires basic knowledge, skills, behaviors, and habits, and is prepared for life and higher education in line with his interests, abilities, and talents. The purpose of primary and secondary education; The aim is to ensure that the child becomes a useful and productive participant in society, as the personality structure that begins to form at this age generally develops in the same direction in the following years, and to provide the child with the quality of a safe social individual. Achieving the goals of education is possible with an educational structure designed appropriately according to the child's physiological and psychological characteristics.

Schools are places that allow students to thrive, provide a sense of community, and encourage collaboration. The society created by the school is a complex structure consisting of human relations, study plans, programs, and daily activities. The physical environment of the school deeply affects whether students like being at school, the quality of teaching, and learning outcomes (Aydoğan, 2012).

The Ministry of National Education has undertaken the responsibility of programming school building requests at the country level, preparing standards by conducting numerical needs analysis, and determining the investment amount. In this study, the applied legal and administrative structures were revealed and the spatial situations of the schools were evaluated.

2. Legal Aspect of School Spaces

The condition of school spaces covers the conditions required for an optimal learning environment. Children's development is a dynamic process, so learning environments must be designed to meet the changing and differentiated needs of the child and support their versatile development with various stimuli. When we look at the education system of the Ministry of Education in terms of spatial needs, it is seen that various areas should be created within the space to enable the necessary activities for the development of children.

- ✓ Ministry of National Education Primary Education and Training Law No. 222
- ✓ Primary Schools Physical Settlement-General Rules numbered TS 9518
- ✓ Occupational Health and Safety Law No. 6331
- ✓ Ministry of National Education Private Education Institutions Standards Directive
- ✓ Regulation on Health and Safety Measures to be Taken in Workplace Buildings and Extensions
- ✓ Ministry of National Education Secondary Education Institutions Regulation
- ✓ Ministry of National Education Preschool Education and Primary Education Institutions Regulation
- ✓ The 11th Development Plan has been evaluated.



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3. FINDINGS and DISCUSSION

3.1. School Location Selection

Various provisions regarding school location selection are included in the seventh Chapter of the Primary Education and Training Law, titled 'Land and Land Affairs of Schools'.

Article 61; "It is taken into consideration that school buildings are in a convenient location in terms of health, education, and transportation.

Public places such as taverns, coffee houses, coffeehouses, bars, electronic game centers, and places where alcoholic beverages are sold must be at least 100 meters from school buildings, door to door. It is stated that during the periods when schools in regions where tourism is intense are on holiday, the 100-meter distance requirement between the above-mentioned workplaces and schools is not required.

In the 5th article titled 'Mandatory Distance' of the regulation regarding the determination of the distances between public places and drinking places and public or private educational institutions;

"There must be a distance of at least 100 meters from door to door between public places, drinking places, and school buildings." A provision similar to the one in the Primary Education and Training Law is included.

In paragraph 'a' of Article 41 of the second Chapter of the Directive on Standards for Private Educational Institutions, reference is made to the Primary Education and Training Law regarding school location and selection. In addition to the referenced article of law; Clause b states that school lands should not be adjacent to state roads, main roads of cities and towns, and commercial roads.

A similar definition has been introduced in TSE for school location selection; unlike the current legal legislation, the distance between school buildings and various public places is specified as 200 meters.

3.2. Building Structure and Features

In 2010, the Ministry of National Education initiated a study to update educational buildings with the publication titled "General Principles of Architectural Project Preparation of Educational Buildings". Later, the study in question was developed and published under the name "*Educational Buildings Minimum Design Standards Guide*" to guide the design of new educational facilities planned to be built in 2013 and 2015. This guide aims to determine design criteria for educational buildings and prevent problems from the past from being transferred to the future (Çelik, 2019).

The Educational Buildings Minimum Design Standards Guide, prepared by the Construction and Real Estate Department of the Ministry of National Education, has been developed to explain the standards that must be followed in projects and to guide planning. It is stated that during the project design phase of all educational buildings planned for new construction, additional buildings, or renovations, the needed programs prepared by the Ministry of National Education, all relevant regulations in force, other current legislation of the Ministry of Environment and Urbanization and the Minimum Design Standards Guide for Educational Buildings must be complied with.



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Educational Buildings Minimum Design Standards Guide, the location selection criteria for the area where the educational building will be built are as follows;

- Educational buildings are close to residential units,
- Compliance with the distances specified in the "Spatial Plans Construction Regulation" prepared by the Ministry of Environment, Urbanization and Climate Change, (According to the regulation, the distance to kindergarten and primary school functions is planned as approximately 500 meters, taking into account the pedestrian accessible distance. This distance is decided by taking into account the characteristics of that region, such as topography, construction status, and existing texture).

The guide ensures that new educational structures to be built meet every need and create suitable educational environments for students and instructors.

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Security

Structural safety of the school building is one of the minimum health and safety requirements in a school. Security studies in and around schools are very important to improve and contribute to a positive atmosphere in the school environment. Ensuring physical security in schools is one of the effective elements of school security.

In the Primary Education and Training Law No. 222, it is stated that "School buildings should be located in a convenient location in terms of health, education and transportation. Public places such as taverns, coffee houses, coffeehouses, bars, electronic game centers, and places where alcoholic beverages are sold must be at least 100 meters from school buildings, door to door.

According to the provisions of the "Regulation on Fire Protection of Buildings", measures for the protection of school buildings must be taken by the school administration.

Building safety is also important, especially in terms of precautions to be taken against earthquakes. In the section devoted to education in the Eleventh Development Plan, the following policies or measures regarding the structural safety of school buildings are included:

- Educational buildings will be designed in an architecture that is compatible with technology and the environment, is safe, economical, aesthetic, accessible, and has high standards and quality.
- Standards of the physical infrastructure of learning environments, curriculum and material richness, self-care skills, integration practices, and guidance services will be increased.



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Target 5.2 of the Ministry of National Education 2019-2023 Strategic Plan, "A justice-based approach model in education will be developed that does not isolate individuals with special education needs from their peers and strengthens the culture of living together."⁵⁴ The items included in the strategies prepared for the target:

- Physical facilities of schools and institutions will be improved, especially for the use of individuals in need of special education.
- Physical facilities of schools and institutions will be improved in line with needs through minor repair and equipment services.

The entrances of the building should be designed and constructed in a way that does not create a security problem, taking into account the environmental conditions. Access to school buildings should be from as few points as possible, making it easier to ensure security and facilitate control and supervision.

The fences surrounding the school and defining its perimeter should be arranged in a way that the school cannot be easily seen or observed from the outside and that it is not possible to climb (Ministry of National Education Educational Buildings Minimum Design Guide, 2015). There should be gathering areas in the school garden after natural disasters and emergencies. Gathering areas should be designed to be easily accessible to individuals with disabilities. If there are stairs at the entrance of the school building, there must be a ramp for the disabled, and the ramp must have features that comply with TS 9111 standards. It is important for the safety of students to have anti-slip tapes on each stair tread. The floors of playgrounds in the school garden should be designed using soft materials, and these materials should be suitable for wheelchair use.

There should be tactile floor applications to enable visually impaired students to move independently within the school and to facilitate access to the sections in the garden. There should be no height difference on the garden floor, a ramp should be designed where there is a height difference and the design of the ramps should comply with TS 12576.

Pedestrian paths and sidewalks should be connected with ramps, and the design of the ramps should comply with TS 12576. Manhole covers designed to remove surface water on pedestrian paths should be placed in a way that does not endanger the safety of pedestrians and individuals with special needs. Materials such as signs, boards, poles, and railings should not be placed on pavements and pedestrian paths, as they will reduce mobility and pose a danger. Underpasses or overpasses by TS 9111 should be constructed on the highways with heavy traffic around the school. Speed bumps should be placed at school entrances and exit openings to the street (Ministry of National Education Educational Buildings Minimum Design Guide, 2015).

Lighting

It is of great importance to provide visual comfort conditions in educational buildings where visual activities such as reading and writing predominate. In educational buildings, where most of the users are students in the developmental age, the necessary visual comfort conditions must be provided to protect the eye health of the students, increase their visual performance, keep their learning performance at a high level, and ensure that they are psychologically satisfied with their environment (Çelik, 2019).



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In the current standard titled TS EN 12464-1: Light and Lighting - Lighting of Workplaces - Part 1: Indoor Workspaces, the minimum values that must be provided in terms of lighting according to different functions in educational buildings are specified.

Through this standard, the necessary information regarding the quantity (brightness level) and quality (glare, light color, light distribution, etc.) of the light to be created in the classrooms, as well as the interior surface materials and equipment, can be accessed.

Sound and Acoustics

Sound level in schools is one of the important factors affecting the school climate. Some studies reveal the relationship of noise with both learning outcomes and students' psychological well-being. Noise exceeding acceptable limits causes students' reading performance and success in tasks requiring mental concentration to decrease, and ongoing noise increases anxiety and stress levels.

According to the Regulation on the Protection of Buildings Against Noise, published in the Official Gazette No. 30082 on 31 May 2017 and entered into force on 31 May 2018, schools are considered "very sensitive areas to noise".

However, there is no Ministry of Education regulation regulating the regular measurement and reporting of noise and acoustic levels in schools.

In the Regulation on the Protection of Buildings Against Noise, it is stated that the lowest acceptable upper limit of Class C acoustic performance for educational facilities is 39 dB. The regulation states that the ideal indoor noise level measurement is 39 dB for classrooms and 49 dB for circulation areas.

Cleaning and Hygiene

The quality of cleanliness and hygiene conditions in schools is a matter of debate within the education system.

To encourage formal and non-formal education institutions affiliated with the Ministry of National Education regarding cleanliness and hygiene, a White Flag Cooperation Protocol was signed between the Ministry of National Education and the Ministry of Health on 3 August 2006.

The expired protocol was signed again on 10.11.2010 and 05.06.2015 and put into practice. Applicant schools are inspected according to the criteria determined within the scope of the protocol, and among the inspected schools, schools that score 90 or more out of 100 points are given a "Certificate", "White Flag" and "Brass Plate", which is valid for three years and symbolizes school health and cleanliness.

Work and operations related to the white flag secretariat and certificate issuance in governorships are carried out by the Provincial Directorate of National Education, and the supply of white flags and brass plates is carried out by the Provincial Health Directorate (URL, 1).

In addition, in 2020, the Improving Hygiene Conditions and Infection Prevention Control Guide in Educational Institutions was created and it was announced that schools that meet the conditions specified in the guide will be entitled to receive the My School is Clean certificate.



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3.3. Outdoor Features

Outdoor spaces of educational institutions are considered an extension of the education provided in indoor spaces. It is important that educational institutions provide children with opportunities to interact with nature in outdoor spaces, play and engage in activities in the open air, and include regular and sufficient activities in these areas in the program, both for the healthy development of children and for them to become individuals who love nature and strive to protect nature.

Children gain concrete experiences by living more and more in their natural environments through their senses. Therefore, when planning these areas, they should be considered not only as playing areas but also as areas where the child will feel happy and free, where he can have different experiences and make discoveries. Outdoor arrangements should be made in line with the abilities, interests, and needs of the children in the age group served by the program.

School gardens provide opportunities for students to socialize during break times; They are places with an important pedagogical value that create playing and learning opportunities for students through the facilities they contain, such as parks, sports fields, and ecological gardens.

The fact that school gardens are important requires improving the quality of school buildings, taking into account the areas outside the building and making arrangements in the garden.

In the practices carried out by the Planned Areas Zoning Regulation (2017), education areas and arrangements are general, covering all cities throughout the country. However, since the geographical and social structure of each city may not be the same, the regulations cannot be implemented as they should in every city or the desired arrangements cannot be seen in school gardens.

It is difficult to apply certain standards for the gardens of schools in different cities and districts but to provide some basic features in school gardens, the characteristics and standards of school gardens are included in the laws, the guides, circulars, and directives published by the Ministry of Education and other ministry units. These;

Ministry of National Education Primary Education and Training Law No. 222 (O.G. No. 10705 on 12.01.1961) states that "Article 64: There is a practice garden adjacent to or near each village school, not less than 2 decares and not more than 10 decares."

Spatial Plans Construction Regulation (O.G. No. 2903 of 14.06.2014).

"Article 12 (2) In zoning plans; "Children's playground, playground, open neighborhood sports area, family health center, nursery, kindergarten and primary school functions can be planned in the service impact area that needs to be reached on foot, taking into account the distance of approximately 500 meters, secondary schools approximately 1,000 meters, and high schools approximately 2,500 meters."

Accessibility standards for disabled people have been announced in the Planned Areas Zoning Regulation (O.G. No. 30113 of 03.07.2017).

Law No. 5378 on Disabled People (O.G. No. 25868 of 01.07.2005) explains the access of disabled people to areas.

Ministry of National Education Secondary Education Institutions Regulation (O.G. No. 29871 of 28.10.2016);



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It is stated as "Article 95: School buildings, facilities, and gardens are arranged by the accessibility requirements of disabled individuals".

Ministry of National Education Preschool Education and Primary Education Institutions Regulation (Amended: OG-10.07.2019-30827)

“Article 90;

(1) In pre-school education institutions;

a) To carry out educational activities in a healthy, appropriate, and safe environment, it is essential to have a playground and a garden and arrange them according to their purpose.

b) Arrangements are made when there is no training. While making this arrangement; Care is taken to support children's motor skills and cognitive development, to enable them to travel and play, to instill a love of the environment, and to allocate sufficient land area for a traffic training track, sand pool, garden play tools and afforestation of the garden.

(2) In primary education institutions, by taking advantage of environmental opportunities for students to travel, play, and engage in sports activities; Places such as sand pools, volleyball and basketball courts, and tools suitable for activities such as hanging, climbing, balancing, and jumping are provided.

(3) Periodic maintenance and repair of the playground and its equipment is carried out at least once a year.

Practice garden “Article 91 (1) In schools with suitable gardens, agricultural studies, and trials are carried out, ornamental plants and trees are planted, and grass areas are arranged.

(2) Fruit trees are planted in suitable places in the practice gardens of schools in villages. “Beekeeping, poultry farming, greenhouse farming, and organic vegetable and fruit production can also be done.”

It covers private education institutions within the scope of the Private Educational Institutions Standards Directive (Authority Approval dated 11.03.2020 and numbered 5331494) and the Private Educational Institutions Law numbered 5580, dated 08.02.2007.

Departments that should be in secondary schools,

“Article 17 Playground: There is a garden area of at least 500 m² suitable for ceremonies. “A 2 m² playground is allocated for each student.”

“Article 19 In case the secondary school and the secondary school or secondary schools are opened in the same building/buildings; These schools can share the health room, parent meeting/waiting area/room, prayer room/place of worship, elevator, multi-purpose hall, dining hall, indoor physical education hall, library and playground.

Article 12, In case the construction license/building occupancy permit is obtained as a school building and several or all of the preschool education, primary school, secondary school, or secondary schools are intended to be opened in these building/buildings; For secondary school/schools, there must be a separate garden, building entrance, access to floors from schools at other levels, and classrooms and student toilets and sinks of that school on the floor/consecutive floors reserved for each school.



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"Circular on the Implementation of the Occupational Health and Safety Law (No. 6331) (OG No. 28339 on 30.06.2012)" and the standard named "Primary Schools-Physical Settlement-General Rules" dated 14.04.2000 and numbered TS 9518 of the Turkish Standards Institute (TS 9518)

School principals, as employers, and teachers, as employees and providers, are obliged to implement the issues in the laws and regulations. It is possible to monitor risks and hazards in the environment by creating a Risk Inventory and Risk Assessment.

It may be possible to examine school gardens based on different criteria. The most important of these criteria is the garden area in square meters per student.

When the legal administrative framework of primary education facility areas in Turkey is examined, within the framework of the "Spatial Plans Construction Regulation" published by the Ministry of Environment, Urbanization, and Climate Change in 2014 and with the amendment made on 17.05.2017, the minimum area size for primary schools is 5,000, regardless of the population number. It is given as $5,000 \text{ m}^2$ and the area per person is determined as 2 m^2 .

According to the Primary Schools-Physical Settlement-General Rules standard numbered TS 9518, dated 14.04.2000 of the Turkish Standards Institute (TSE), usage areas in school gardens should be planned to provide 5 m^2 of space per student.

- 1.1.9 - The school field must be surrounded by a garden wall; water, electricity, and sewage facilities must be available; Entrance and exit doors of the school should not open to a street with heavy traffic; Seating groups suitable for the size of student age groups should be placed in the garden and open sports areas should be arranged according to age groups.
- 1.1.10 - An open ceremony area should be arranged in the school garden, there should be an Atatürk monument or bust, this monument or bust should be illuminated, and there should be a sound system.
- 1.1.11 - Drinking water installation should be by TS 828, utility water should be by TS 266 and taps should be arranged in the break room and playground.
- 1.1.13 - The school must have a parking lot with the features specified in TS 10551.
- 1.4.6 - There should be a canteen within the school building or in a suitable place in the garden where students can purchase stationery, soft drinks, toast, etc.
- 1.4.11 - The parking lot must be far enough away from the private teaching institutions, if the population of the district where the school will serve is between 50000 and 200000, at least $250,00 \text{ m}^2$ for the gross school construction area of $600,00 \text{ m}^2$; If the population is more than 200,000, at least $500,00 \text{ m}^2$ of parking space should be reserved, the ground should be covered with concrete, asphalt, concrete paving etc. in a way that will not be mud and water will not collect, and if possible, it should be closed.
- 1.4.13 - The garden should be away from harmful elements such as noise, smoke, and dust, and have a soil structure suitable for growing plants and trees, there should be a perimeter wall, drinking water fountains, seating corners, and open sports areas should



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be arranged in a suitable corner of the garden, and a sufficient number of garbage bins should be placed.

- 1.5.4 - If there are student shuttle services at the school, there must be a parking area for shuttle vehicles and a waiting room for shuttle drivers with the features specified in TS 12257.

4. CONCLUSION and RECOMMENDATIONS

Compared to the Ministry of Education (1997), the standard determined by TSE (2000) foresees more open space per student.

However, in the next article of the relevant standard; 1.1.3 - While placing the building on the land, it is stated that it should be taken into consideration that the school building may be expanded in the future, and it is noted that this article, which foresees the reduction of the amount of open space in question, contradicts itself with the standard.

In the Educational Buildings Minimum Design Standards Guide, for school gardens built after 2015, it is stated that "Concrete and asphalt surfaces should be avoided so that school gardens do not have a cold and monotonous appearance, by the landscape project, large grass areas designed with a nature-based approach and climate control along the schoolyard perimeter wall." It recommends the standard "A regulation should be made that includes trees suitable for the region".

However, there is no regulation for old schools. According to the guide, buildings should be designed not to exceed 35% of the total area under optimal conditions. The remaining 65% of the area should be used as open space, green areas, and playgrounds.

In the determination section of the Ministry of National Education 2019-2023 Strategic Plan regarding the goal of including innovative practices that will increase the quality of schools in basic education.

It is stated that "School gardens are insufficient to support the social and cultural development of students".

Among the needs that must be met for the same goal, it recommends that "School gardens should be designed to support the versatile development of students and that lessons and extracurricular activities should be supported with cultural gains."

As social spaces that contribute to the mental, physical, and spiritual development of students, school gardens have an important share in ensuring the continuity of education and increasing its quality.

It should be aimed to make schools that encourage an active lifestyle attractive and enjoyable for students by arranging them with adequate equipment, green areas, and outdoor sports facilities.

To achieve the stated goals, a sufficiently large ceremony area, promenades, open and green areas should be left in school gardens, and outdoor sports facilities (volleyball, basketball, mini football fields) surrounded by wire fences and areas suitable for traditional children's games should be reserved.



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**ISPARTA UNIVERSITY OF APPLIED SCIENCES CENTRAL RECTORATE
BUILDING PLANT DESIGN**

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ABSTRACT

Universities aim to provide professional skills through academic education and practices, to produce knowledge by conducting scientific, social, and economic-based practices and research, to prepare young people for social life by giving them duties and responsibilities, and to contribute to the education, awareness and cultural level of the society. Considering the city-university relationship of universities in cities, it aims to contribute to the spread of an ecological lifestyle due to their innovative features and their leading roles in society. For this reason, an important responsibility has been assumed when looking at the on-campus planting studies from this point of view. It has become an inevitable necessity for the campuses to be designed in accordance with ecological criteria, together with the buildings and open spaces. In the planting works, which are the most prominent in the campus, it is necessary to take into account the functional effects of the plant species to be selected, as well as their aesthetic effects. Plant species that can create a different effect in all four seasons in terms of color and texture characteristics should be included between buildings, squares, walking paths and special points. Noise, wind and dust curtains should be built where necessary. In the planting works, which are the most prominent in the campus, it is necessary to take into account the functional effects of the plant species to be selected, as well as their aesthetic effects. Plant species that can create a different effect in all four seasons in terms of color and texture characteristics should be included between buildings, squares, walking paths and special points. Noise, wind and dust curtains should be built where necessary. In this study, the plant design project of the central rectorate building of Isparta University of Applied Sciences, located in the city center of Isparta, will be discussed and evaluated at the campus and city scale.

Keywords: University, Design, Plant Design.

1. INTRODUCTION

Universities, which are among the institutions where knowledge is produced and shared, have an important role in the development of societies and therefore individuals.

While university campuses serve the use of students for educational purposes, they also appear as intensive social areas due to the recreational opportunities that students and university employees have in their extracurricular activities.



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When we look at the city-university relationship of universities located in the city center along with the development of cities, universities contribute to the spread of an ecological lifestyle in the city due to their innovative features and leading roles in society.

Ecological design, one of the most important concepts of today, is a key concept that aims at high efficiency and aims to ensure that the functions of any social, economic or ecological system continue uninterrupted without damaging or consuming the resources used. In this context, it is necessary to develop microclimatic data, effective energy and material resources, effective use of topographic data, effective use of natural resources and evaluation of vegetation.

The design studies carried out on the campuses should enable many functions such as ensuring the integrity of the environment by considering the existing structural areas and open-green areas as a whole, creating circulation for vehicles and pedestrians, suggesting suitable areas for physical developments and uses, and creating recreational areas (Akten & Torun, 2021). University campuses, where green cover is dominant, provide many positive contributions to the people using the space (Hipp et al., 2016). When viewed from this perspective, an important responsibility has been assigned to the planting activities on campus. Designing campuses, including buildings and open spaces, in line with ecological criteria has become an inevitable necessity. Plants have positive effects on the area by changing the temperature in their environment by a few degrees, such as heat control, stopping wind, precipitation and radiation. According to Liu and Sullivan (2016), seeing a green environment in the classrooms within the educational fabric reduces students' stress and mental fatigue.

Designers need to choose the right plant that will have an impact on the climate, considering the current climate conditions and human needs for comfort.

Botanical design; In addition to being a branch of art that emerges as a result of the relationship between humans and nature, they also adds different meanings and functions to the spaces where they are used, depending on their aesthetic and functional purpose, by helping to restore the balance between humans and nature. Planting works, which are the most visible on campus, should be carried out by taking into account the functional effects as well as the aesthetic effects of the plant species to be selected (Akten & Gül, 2007).

In addition to creating spaces with high visual quality in botanical design works, the use of vegetal structures (leaves, flowers and fruits) is also very important. For this reason, designs should be considered multifunctional within the "urban open and green space system". Plant species that can create different effects in four seasons should be included between buildings, in squares, on walking paths and at special points, in terms of color and texture. Noise, wind and dust curtains should be installed where necessary.

University campuses have undertaken the task of creating a model on a universal, national and regional scale with their land use, structural and plant designs all over the world. Rectorate buildings, which are the administrative structures that make up the dynamic structure of universities, hold an important place in university campuses in the physical context, while at the same time, they are the showcase of the university in social terms. Therefore, campuses are areas that provide aesthetic, ecological, economic, and recreational contributions as well as their socio-economic and cultural contributions to the cities they are located in with their open and green space planning (Akten & Torun, 2022).



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The goal of ecological landscape designs is to create landscape areas where plants grow healthy, grow well, and require little maintenance. In this respect, choosing the right plant in design is a prerequisite for achieving this goal.

In this study, the plant design project of the central rectorate building of Isparta University of Applied Sciences, located in the city center of Isparta, was discussed and information was given about the plant design studies.

2. MATERIALS and METHODS

Materials

Isparta University of Applied Sciences Rectorate building is located in Doğancı District in the center of Isparta (Figure 1).

On December 9, 2019, an area of 62.000.500 m², including 6 buildings, including the old hospital building, was transferred from the National Real Estate Directorate of the Provincial Directorate of Environment, Urbanization and Climate Change to Isparta University of Applied Sciences (URL, 1). Project work started immediately after the allocation of the study area to the university. Within the university's central campus;

A Student Dining Hall with a capacity of 1000 people, a Staff Dining Hall with a capacity of 400 people, Social Areas, a Pocket Cinema with a capacity of 68 people, and a Theater Hall with a capacity of 83 people, with a total construction area of 5,647.80 m², are planned as student living areas in Zirve Campus. In addition, a Conference Hall with a capacity of 340 people, 2 Congress Halls with a capacity of 115 people, 3 Meeting Halls and 2 Foyers (Exhibition Area) will be built within the 4.188,90 m² Congress Center.

There will be 58 Classrooms, 5 Lecture Halls, 2 Meeting Rooms, 4 Seminar Rooms, 3 Computer Halls, 8 Computer Laboratories, 2 Technical Drawing Halls within the 14,000 m² area.

The Total Construction Area of the building, which is being constructed by Isparta City Services Association, is considered as an additional building for central classrooms in the area of the Old Maternity Hospital: 5100 m². 1500 Student Capacity, 16 Classrooms, 1 Technical Drawing Hall, and 18 Staff Rooms are planned (URL, 1).



Figure 1. Isparta University of applied sciences zirve campus (Google Earth, 2023)



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The study area is the historical building (old state hospital building) known as the Stone Building, built in 1946, located within an area of 4080 m², and the new rectorate building around it (Figure 2, Figure 3).



Figure 2. Rectorate building front view



Figure 3. Rear view of the rectorate building

Methods

The study was carried out by evaluating the current situation in the rectorate building and the surrounding campus area, observations made within the boundaries of the study, photographs taken and determinations within the scope of ecological design principles.

Within the scope of the study firstly, the spatial and operational requirements of the historical building, which was protected and maintained with a new function, were determined and analyzed, taking into account the features that constitute its identity.

By examining open and green space usage requirements and outdoor usage needs through spatial analysis, the following evaluations were made:

Determination of exterior opening points and elevations of the existing building,

Determining the relationship between the circulation system and parking needs within the project area,



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Determining user needs,

Analysis of natural landscape data.

In addition, a literature review, on-site observation, and functional analysis of the historical building environment converted into a university building were carried out.

Findings and Discussion

The historical building (former state hospital building) and its surroundings, known as the Stone Building, built in 1946, will be opened for use as the new rectorate building upon completion of the restoration work.

Natural factors such as land and environmental relations, land topography, relationship with the city, climate condition, soil properties, and geological structure are very effective in planning decisions regarding campuses.

The basis of ecological design on campuses is based on understanding the relationship between environmental processes and user needs. Physical, biological and social relationships are within the scope of landscape design.

The ecological approach in landscape design and management requires taking nature itself as a model in area design and bringing solutions that are compatible with natural processes and the structural and ecological characteristics of the area.

The main goal is to develop a self-sufficient, sustainable system that can be a part of the urban ecosystem.

During the plant design process, the campus area and its surroundings were examined and its relationship with its immediate surroundings was revealed.

In line with the environmental data determined, attention was paid to preserving the image and identity values of the rectorate building due to its historical features.

The existing vegetation in the area has been accepted as a guiding feature in vegetative design. All plants in the area were preserved, and care was taken to ensure that the new plants selected were compatible with the existing plants and suitable for climatic factors.

To begin with, 25 different types of plants were used in the project for the first stage.

Species names;

Magnolia grandiflora, *Liriodendron tulipifera*, *Prunus cerasifera*, *Morus pendula*, *Cercis siliquastrum*, *Malus floribunda*, *Tilia tomentosa*, *Laurus nobilis*, *Tamarix sp.*, *Olea europea*, *Lagerstromia indica*, *Abelia grandiflora*, *Chaenomeles japonica*, *Ligustrum vulgare*, *Eonymus japonica var. Aurea*, *Lavandula officinalis*, *Berberis thunbergii*, *Photinia red robin nana*, *Pittosporum tobira 'nana'*, *Viburnum opulus*, *Buxus sempervirens* *Ajuga reptans*, *Nandina domestica*, *Cotoneaster horizontalis*, *Vinca major*.

When choosing plants, attention was paid to the change in the form of deciduous and evergreen trees over the years.

The vegetated areas within the campus, which are located within the dense urban structure, will also serve as the green area of the city. On the other hand, plant material also has effects such as air quality control, slope stabilization, and climate regulation.



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It is aimed to create a visual landscape, noise reduction, or air quality improving effect by creating a "green belt" effect around the building's road axis. Shrubs were mostly used at the borders of the area to protect from noise and dust.

Since the Rectorate building is located on the main road axis, areas arranged at different elevations have been created with planting in order to reduce the noise caused by pedestrian and vehicle flows and not to draw attention to other directions. In this area, *Malus floribunda*, *Tilia tomentosa*, *Tamarix sp.*, *Laurus nobilis*, *Abelia grandiflora*, *Chaenomeles japonica*, *Ligustrum vulgare*, *Lavandula officinalis*, *Berberis thunbergii*, *Photinia red robin nana*, *Pittosporum tobira nana*, *Ajuga reptans*, *Cotoneaster horizontalis* and *Vinca major* plants used.

Since the Rectorate entrances are also an important institutional symbol in addition to their general functions, attention was paid to the use of attention-grabbing plants for emphasis.

The front garden, where the main entrance of the Rectorate building is located, was designed as a welcoming area and was intended to be emphasized with plants. For this purpose, *Olea europea*, *Eonymus japonica var. aurea*, *Lagerstromia indica*, *Photinia red robin nana*, *Buxus sempervirens*, *Malus floribunda* and *Cotoneaster horizontalis* plants were used.

In the road connections within the area, plants that are the same in form, size, texture and color are included, again taking into account the principle of rhythm, unity and balance.

The part of the Rectorate building opening to the backyard was used as a places where recreational activities were held. While users are provided with the opportunity to rest, sit, watch and move actively, the design has been shaped by considering the naturalness provided by grass surfaces, plants and area plastic.

It is aimed to create shaded and cool areas, protected against weather conditions, by using plant and structural materials in the seating areas at the back of the rectorate building.

Two different spaces were created on the campus by creating horizontal and vertical planes with different types of plant materials used. Tall plants were used for screening purposes between these areas.

In addition, the herbal materials used:

- ✓ complementary,
- ✓ router,
- ✓ unity builder,
- ✓ softening the sharpness of the space resulting from its structural form,
- ✓ Care was taken to create a design that frames the view of the area to introduce and emphasize its historical features.

Morus pendula, *Prunus cerasifera*, *Lavandula officinalis*, *Berberis thunbergii*, *Viburnum opulus*, *Liriodendron tulipifera*, *Pittosporum tobira Nana*, *Abelia grandiflora*, considering their functional functions such as accessibility in the parking lot and road route, characterizing the space, creating a backdrop, establishing a relationship with the rectorate entrance, and orientation plants such as were preferred.



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Creating a buffer area with the planting used around the designed parking areas is aimed at hiding the harsh appearance of the parking areas and at the same time creating shadow areas for the vehicles.

The ramp used as a pedestrian entrance was evaluated as a negative image in terms of design due to the materials used with the historical building and the slope analysis.

Creating an area compatible with the stone material used in the structure of the existing building, which is unique to traditional buildings, and emphasizing the main entrance with plant pots as a welcoming area at the entrance were considered at the design stage.

3. CONCLUSION and RECOMMENDATIONS

Today, many of the cultural assets that are protected due to their historical values in the world and our country can become sustainable with a second function. Reintroducing and using the structures evaluated in this way to the society; Although they remain neglected and abandoned structures, they are considered a positive initiative.

The change in the function of an existing and previously used building, depending on the changing conditions and needs of the period, also leads to design studies taking into account the preservation of the historical values of the place.

Creating a space identified with its new function contributes to making it livable. In this context, the existing stone building, which has survived structurally but lost its identity functionally, will assume a new function when it begins to be used as the university rectorate building, and in this process, it will gain an ecological and aesthetic value with the vegetal designs made in the open and green areas around the building, which will contribute positively to the city of Isparta. It is thought that it will contribute. For this purpose, a holistic, balanced campus design scenario that takes into account the values of the geography in which it is located was developed with the decisions taken in the plant design of the Rectorate Building of Isparta University of Applied Sciences Zirve Campus, located in the city center.

In the campus, open and green area design, attention was paid to preserving the architectural character of the building and improving its visual character. In addition to their basic functions, the materials used in campus outdoor design can also have a complementary effect on spaces with their qualitative features. For this reason, the plants used in the campus vegetal design help preserve the unique identity of the campus.

Using local plants, is aimed to reduce maintenance costs and allow the plants to adapt to the environment without experiencing any adaptation process or losses. In plant design, attention was paid to creating a space design that is ecological and functional, resistant to climatic conditions, contributing to the identity and prestige of the university, compatible with the environmental texture, directly related to the educational texture, and usable day and night.

In the vegetative design of the area, the existing vegetal texture, mainly *Pinus nigra*, which was previously randomly planted in the area, has been completely preserved. For the educational texture around the area to form the plant design decisions, sequential plant designs that can create a visual impact in all seasons were used.

When the plants reach the designed sizes and diversity and the equipment takes its place in the spaces, the designed project will have a more effective appearance. In addition, after the plant use study of the Rectorate building is completed, some additions and deletions can be made in



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the application by taking the opinions of those who use this area with the "post-use evaluation" method, and the findings obtained from this evaluation will be guiding in the other phase studies of the campus.

Thanks and Information Note

Isparta University of Applied Sciences Zirve Campus Rectorate plant landscape design project was prepared and delivered to the Construction and Technical Works Department on 08.03.2023.

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ANALYSIS AND INTERPRETATION OF THE ISTANBUL NAVAL MUSEUM

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ABSTRACT

Architectural project competitions have a great impact on both the architectural sector and architecture education. To guide and inform as an instructive resource on behalf of the competition sector, this research was conducted through the Istanbul Maritime Museum for the examination of architectural project competitions. For this research, the Istanbul Maritime Museum Architectural Project Competition, organized by the Turkish Naval Forces Command in 2005, has been examined chronologically and focuses on informative points about architectural project competitions by archiving the specifications, the list of needs, the winners during the competition process and the drawings of the winner project. In the further process of the research, the first prize-winning project made by Teğet Architecture was examined by the architectural drawings, the construction process and the completed version of the structure's comparison. The transformation process of the architectural project was observed and documents acquired by Teğet Architecture, articles written about the Istanbul Maritime Museum, and interviews published in journals have guided the development of the research. To ensure that the employees of the museum participate in the examination process, different interviews are indicated in the report. The research was intended to guide the studies about the Istanbul Maritime Museum and contribute to the development of architectural project competitions. The report was completed by studying on obtaining the academic data necessary for the interpretation of the Istanbul Maritime Museum competition.

Keywords: Istanbul Naval Museum, Naval Museum, Architectural Project Competition, Museums, Architecture.

1. INTRODUCTION

The naval museum was opened for the first time in 1897 as a small building called 'Museum and Library Administrative' with the permission of Sultan II. Abdulhamit. In 1961, it was moved to its current location, Iskele Square in Besiktas district, where Barbaros Hayrettin Pasha's monument and tomb were located, and it was put into service as the 'Directorate of Maritime Museum and Archive'. It was first opened for exhibition as a museum warehouse, and categorization was made in 1914 when Cemal Pasha, who was the Minister of the Navy, appointed the Sea Captain and painter Ali Sami Boyar, as the museum director. In 1917, Ali Sami Boyar established the 'Ship Model Workshop' and the 'Mulaj (casting)- Mannequin Workshop', which enabled the maritime museum to develop visually. At the beginning of the 20. century, the aircraft hangar located next to the museum's main exhibition building was allocated to the museum as a boat repair workshop and garage. The building was started to be



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used in 1971 as an area where galleys and reign boats in the maritime museum collection were exhibited under the name of 'Historical Boats Gallery'. Since the problems caused by the fact that the Historical Boats Gallery was not built as a museum and could not provide enough space, could not be solved, the Naval Forces Command announced an architectural project in 2005 and announced the competition that made the Istanbul Maritime Museum.

In 2008, the procurement for the new museum building was finalized and the construction of the project, which includes the Main Exhibition Building, the Historical Boats Gallery, and Outdoor Exhibition Areas, was started. A temporary warehouse was built to protect the boats during the construction process, and the boats were moved to this warehouse in 2009. In 2013, the restoration works were completed and the Historical Boats Gallery was opened to the public.

2. MATERIALS and METHODS

During the research process, the direction of writing the report was given by conducting the review from multiple sources and the necessary literature review, archiving the sources found through multiple architectural journals. To access the necessary documents of the Architectural Project Competition, such as feedback and drawings of the winning projects and specifications of the competition, resources were collected by contacting different digital archives. To be able to examine the architectural project competition in a multi-layered way, the necessary process was prepared, so that the stages from the announcement of the competition to its construction could be followed chronologically.

The competition was announced by the Turkish Naval Forces Command in 2005 as a National and single-stage Architectural Project Competition. The main jury consisted of Mete Ünal (Prof. Architect), Afife Batur (Prof. Architect), Mine Inceoğlu (Prof. Architect), Ihsan Mungan (Prof. Civil Engineer), Hüsenyin Kahvecioğlu (Asst. Assoc. Dr., Architect), who are valuable leading names in the development of Turkish architecture. Likewise, the participation of valuable names from the naval forces command in the consultant jury, such as Bülent Aksaray (Dz. Kd. Colonel) and Aydın Soğukpınar (Eng. Lieutenant Colonel), was a supportive fact that the competition was evaluated and reviewed as a joint study.

The list of project requirements that have been approved for the competition is shown below. the desired areas other than some private living quarters and technical environment usage areas are shown in Table 1.



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Table 1. Istanbul naval museum architectural competition requirement list

exhibition areas	
display of royal boats (average value)	6000 m2
object display	1000 m2
cultural areas	
temporary exhibition hall	400 m2
multi-purpose hall (at least 200 people)	450 m2
visitor cafeteria+kitchen(50 people)	180 m2
library	50 m2
cinevision room	50 m2
children's lounge	100 m2
service area	
consultation-promotion-book sale-souvenir	20 m2
wc(male-female-disabled)	
exhibition warehouse (3 units, one of which is 150 m2)	450 m2
workshops	
painting workshop (1 person)	20 m2
wood restoration workshop (1 person)	20 m2
Conservation Workshop (2 persons)	40 m2
chemistry laboratory (1 person)	20 m2
ship model restoration workshop (1 person)	20 m2
carpentry shop	50 m2
electrical workshop	20 m2
electricity warehouse	20 m2
paint warehouse	20 m2
gift-book warehouse	20 m2
offices	
male-female wc	20 m2
commander	20 m2
administrative office (2 people)	12 m2
public relations (1 person)	10 m2
supply branch manager	10 m2
supply office (5 people)	30 m2
property treasurer (2 persons)	12 m2
head of the museum group	12 m2
museum department manager	12 m2
museum researchers (3 people)	18 m2
exhibition part (4 people)	24 m2
museum department supervisor (3 people)	18 m2
security service team (4 people)	24 m2
briefing-meeting room	50 m2
tea Center	10 m2
open spaces	
children's playground (minimum)	500 m2
open display areas (minimum)	1000m2
private living quarters and technical environment	568 m2
THE TOTAL AREA WILL BE 11.000 M2 at the most.	

The documents to be given to the contestants include various documents such as competition specifications, zoning plan, ground condition plankote study, museology report, objects to be exhibited and information about optimal exhibition conditions, property information, current historical boats gallery and boats layout plan, current exhibition building plan sketch and photos. The documents requested from the contestants are situation plan(1/500 scale), plans(1/200 scale), sections and views (1/200 scale), details(1/50 scale), free explanatory drawings, model (1/500 scale), perspective, explanation reports to be added to the project.



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Figure 1: 1st place naval museum Project (<https://www.arkiv.com.tr/proje/http---arkivcomtr-proje-istanbul-deniz-muzesi-2784/2784>)

1st place project No.40: Teğet Architecture

- Architects: Mehmet Vehip Kütükçüoğlu, Ertuğ Uçar, Hande Köksal
- Assistants: Mehmet A. Kiremitci, Mert Uçer, Yıldız Aslandogan, Esatcan Coskun,
- Static: Hakan Çatalkaya
- Machine: Mehmet Okutan, Celal Okutan
- Electricity: Hayri Aydin

The comments made for the first prize project by reaching the specifications and feedback of the project are as follows:

“As Simplicity and success in the building form, interior design and external reflection of the museum's general exhibition concept, functional relationships created starting from the building entrance, maturity and advanced level in spatial organization, effective public space created at the approach and entrance via Dolmabahçe Street, uninterrupted exhibition environment made possible by the selected carrier system setup, the possibility of multidimensional perception offered by this setup with the building structure, success in embodying the conceptual approach developed on the exhibition of the reign boats in space, the mastery in participating in the exhibition context of the visual relationship provided by the outward openings with the strait, the contribution of the reflections that the water element on the sea front will create in the space where the boats are exhibited to the space, the presentation of the possibility of perceiving the boats from the outside in a measured way on the sea front have been found successful. This project is a project in which the entire internal and open space circulation can be controlled from a single point of view by joining the museum circulation axis of the existing exhibition building, in other words, the internal movements of the museum can be completely solved from the point of view of enterprise security. The smallness of the open exhibition area and green space left in response to all these positive features, the problems observed in the floor selection and organization of private living quarters and administrative spaces, the weakness in the stairway and ramp system connecting the entrance hall and the galleries, the problems in the installation scenario during the construction process were seen as the negative aspects of the project. As a result of the evaluation made in this project, a mature and generally qualified museum structure design has been achieved; it has been concluded that the structure, with which the problems and disadvantages it carries can be solved by the recommendations of the jury without disturbing the main decisions of the project, has no problems in terms of technology



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and cost-realizability. The project was unanimously awarded the first prize” (<https://www.arkitera.com/yarisma/istanbul-deniz-muzesi-ulusal-mimari-proje-yarismasi/>)



Figure 2: 2nd Place Naval Museum project (<https://www.arkitera.com/proje/2-odul-istanbul-deniz-muzesi-ulusal-mimari-proje-yarismasi/>)

2nd place project No:36

- Architects: Cem İlhan, Tülin Hadi
- Assistants: Arcan Aksakaloğlu, Şefika Güner
- Static: Yusuf Timbrı
- Machine: Ayşegül Yıldız
- Electricity: Metin Sıcakyüz

The comments made for the second prize project by reaching the specifications and feedback of the project are as follows:

“The logic and fiction of the general exhibition, the customized location of the historical galley and the visual relationship it establishes with the open exhibition areas, the integration of the water element in open areas with indoor spaces, the fact that a suitable environment for museology could be provided in good conditions, the easing of the mass spread over the land to the evacuees from place to place are the positive aspects of the project. Weaknesses in the location and spatial layout of the main entrance of the museum, weaknesses in the transition from the entrance hall to the exhibition hall and the solutions for connecting the new building to the existing building, the location of the er living quarters and entrances on Dolmabahce Street, the inability of the building to open with pedestrian access to this street and the sea direction, the deaf structure of the sea facade, the visual quality of the building is not strong enough in terms of the museum image were seen as negative aspects of the project. The project was unanimously awarded the second prize.” (<https://www.arkitera.com/yarisma/istanbul-deniz-muzesi-ulusal-mimari-proje-yarismasi/>)

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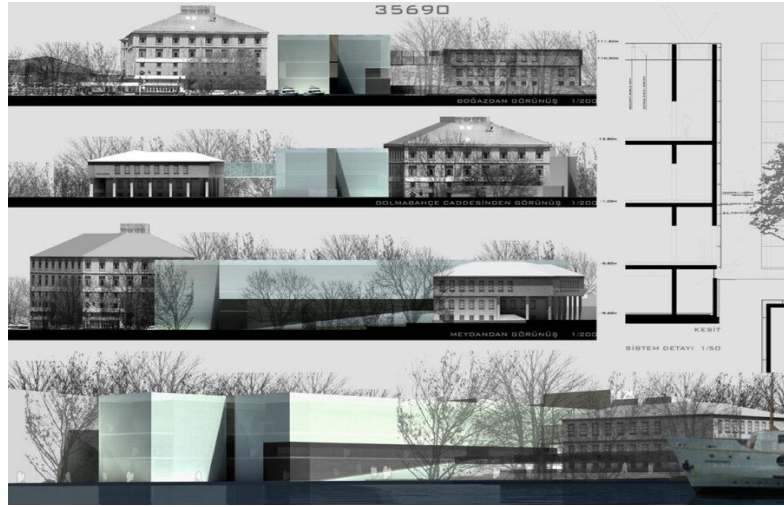


Figure 3: 3rd place naval museum project (<https://www.arkitera.com/proje/3-odul-istanbul-deniz-muzesi-ulusal-mimari-proje-yarismasi/>)

3rd place Project No:28

- Architects: Dilek Topuz Derman, Fırat Gülmez, Cihan Sinan Bostancı
- Assistants: Onur Canvarol
- Static: Niyazi Parlar
- Machine: Caer Aktürk
- Electricity: Hayri Aydın

The comments made for the third prize project by reaching the specifications and feedback of the project are as follows:

“The minimalist and simple approach in the solution of the building, the rich green areas and outdoor spaces obtained accordingly, the separate display of boats in their own private spaces, and the transparent outer walls also offer visitors the opportunity to perceive the open exhibition areas during internal circulation were found positive. The entrance hall, existing building connection and relationship weaknesses in internal circulation and illegibility sometimes turn into directionless and insufficient circulation areas, indoor ramp slopes reach a challenging level, construction stages of the building and uncertainties in the positioning of boats into the building, location selection of early living quarters and offices and related spatial inconveniences are the negative aspects of the project. he was awarded the third prize with a majority of 3-2 votes.” (<https://www.arkitera.com/yarisma/istanbul-deniz-muzesi-ulusal-mimari-proje-yarismasi/>)

3. FINDINGS and DISCUSSION

The new building of the maritime museum is designed around a courtyard that can be considered an open-air exhibition space, taking the museum visitor to the entrance hall from Dolmabahçe Street, and the square-shaped circulation in the museum around the courtyard, the visitor completes his uninterrupted museum tour by passing through the existing exhibition building and back to the entrance hall. At the entrance hall, the building is divided into two zones A and B zone. A contains reign boats, full and half ship models, and other objects, while

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zone B consists of a multi-purpose hall, foyer, exhibition hall, entrance hall, library and other support units. Zone A has two separate sections within itself:



Figure 4. Before and after drawings of naval museum situation plan (<https://www.arkitektuel.com/istanbul-deniz-muzesi/>)

Boathouse: The boathouse is the place where the main collection is exhibited. At the entrance to the boathouse, the largest sultanate ship, which is 58 tons, faces the sea, but it is visible beyond the stairs, and a view of Besiktas port can be seen from above. In the same way, it is seen that the reign boats are ordered historically in chronological ways. While an uninterrupted view is provided on the ground floor with steel bridges seated on reinforced concrete curtains, the mezzanine floor, where smaller boats are located, allows the ground floor to be perceived from the upper level.

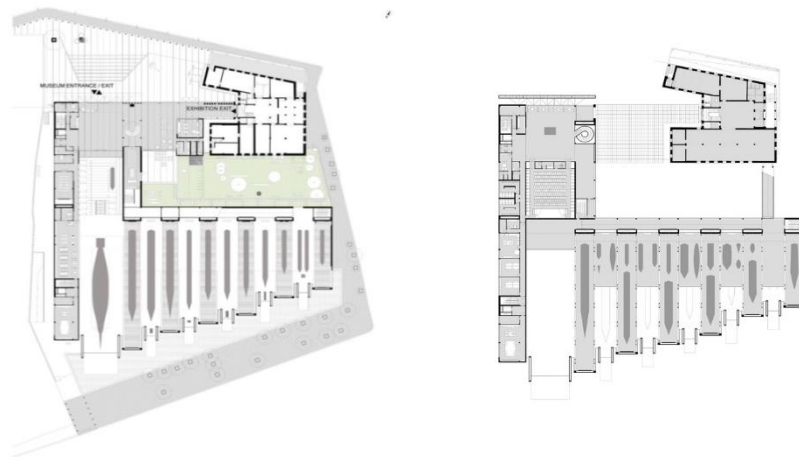


Figure 5. Istanbul Naval Museum ground (left) and first (right) plan drawings (<https://www.arkitektuel.com/istanbul-deniz-muzesi/>)

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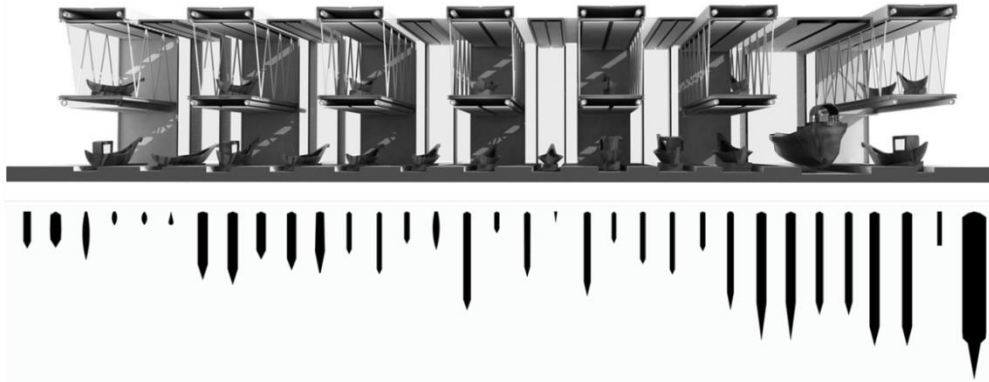


Figure 6. Istanbul naval museum section drawing of the boathouse
(<https://www.arkitektuel.com/istanbul-deniz-muzesi/>)

It is seen that the reign boats are exhibited on the ground floor of the new museum building and are placed on wooden seats specially made for the size of the boats, which are surrounded by metal ropes to protect the wood from touch. The undivided circulation of the ground floor with columns was designed as turning around the reign boats with the guidance of metal ropes, and a comfortable corridor network was created through which wide openings were passed. It is seen that the ceiling and floor wall units are made of copper material in a color to match the reign boats, and artificial lighting mixes with the flow of architecture with copper material units.

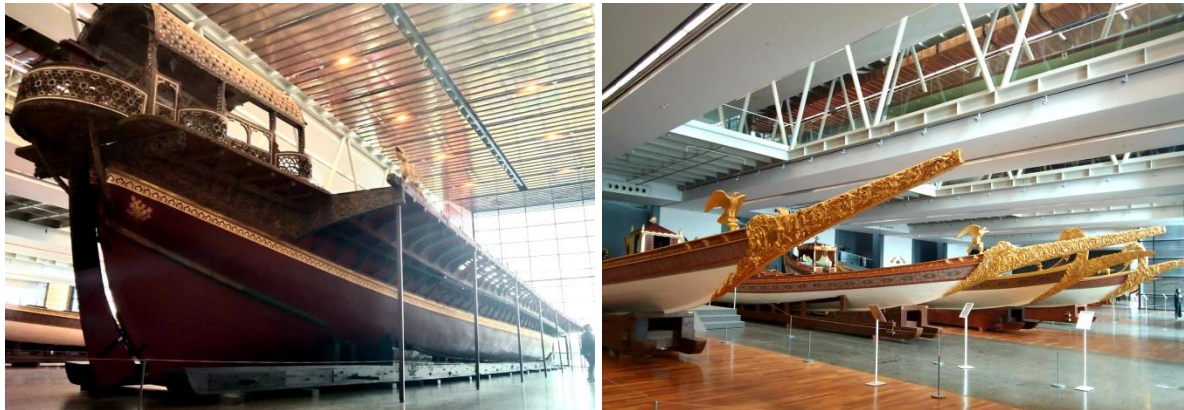


Figure 7. Istanbul naval museum boathouse ground floor photos (from the photo archive taken by the author)

Teğet architecture's description report describes the project as follows: The existing Maritime Museum in Beşiktaş is a lost, forgotten complex in the center of Istanbul. The developed proposal, together with its invaluable content left in a nook, puts this area on the shores of the Bosphorus of Istanbul into the use of the city. (...) The designed new Istanbul Maritime Museum complex is built around a courtyard that is considered an open-air exhibition space. The boathouse is the place where the main collection of the Istanbul Maritime Museum is exhibited. The boathouse is shaped like fingers extending from the first hall, where the Galley is displayed in the westernmost, to the last hall, which is divided by a steel bridge in the easternmost, to the sea. The boats lined up on the dock as in their former lives want to return to the sea. (<https://www.arkiv.com.tr/proje/http---arkivcomtr-proje-istanbul-deniz-muzesi-2784/2784>)

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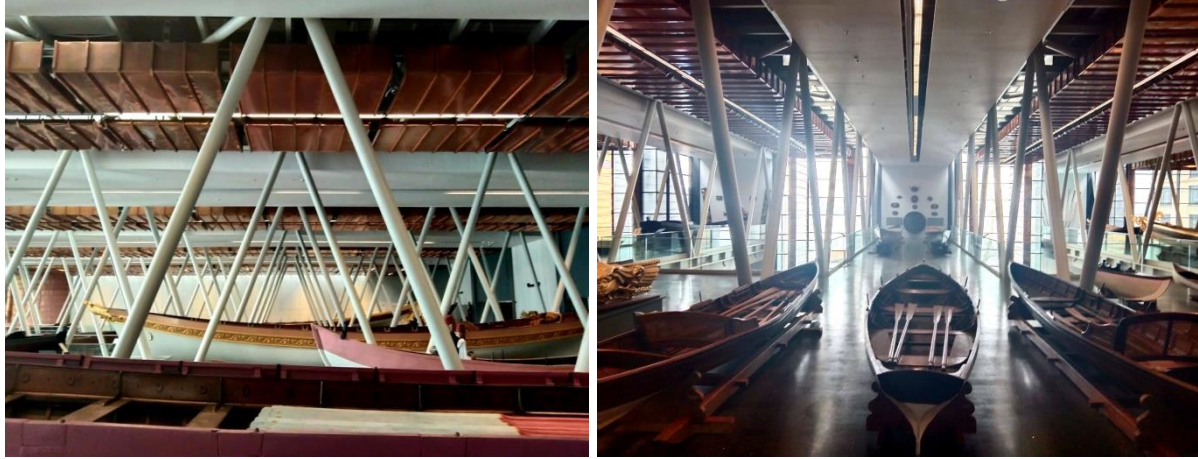


Figure 8. Istanbul Naval Museum Mezzanine floor photos (from the photo archive taken by the author)

Transportation from the ground floor of the new museum building to the first floor is provided by a ramp at the very end of the circulation network. It has been observed that the information boards with miniature models of famous submarines, ships, and boats hanging on the left side of the ramp, it was used in the informative function. It is also seen that the exhibition of the reign boats is continuing on the first floor of the new museum building and that the exhibition is made of intermittent sections carried by steel structures that serve both aesthetic and architectural purposes.

The Current Exhibition Building: The existing building in the Istanbul maritime museum is supported instead of being closed by the new building and is connected with a bridge to the upper level of the existing exhibition building from the mezzanine floor of the new building. The circulation continues downwards and directs the tour to the starting point. In the old museum building, a dark exhibition hall is opened and there are models, items, and descriptions of sailors and ships in history in this area. The dark exhibition halls on the first floor of the building have been solved on a single corridor axis with a plan that does not require the individual to move around.



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Figure 9. Istanbul Naval Museum Bridge between mezzanine floor and upper level of the existing exhibition building and exhibition hall (from the photo archive taken by the author)

With the contribution of the researched interviews and the documents obtained from the Teğet Architecture office, it was possible to examine the participation and design process of the Istanbul maritime museum competition. The interviews given by the architects of the Istanbul maritime museum and the points they emphasize about the structure are of great importance. Some of the explanations obtained to ensure the multifaceted intelligibility of the building are shared within the scope of the study:

- What we propose with the structure of the Maritime Museum is a calming in the stifling atmosphere of the center. The square we have created on the Dolmabahçe side by retreating from the Decking line is a new stopover, a meeting place for people stuck on the sidewalks. This area, which is included in the city space with a gesture, shows the stance that the museum will take on its social role. The facade surfaces and lines that surround the island and cover all the facades in the registered building breathe into the urban fabric, which is fragmented into a thousand facades in small parcels. The perception that is tired in the city is resting on large surfaces. (interview sections obtained from documents sent by Teğet Architecture)
- Of the 34 boats to be exhibited, 20 of them are more than 10 meters long and 8 of them are more than 20 meters long. The most valuable piece is 16. it is a 40-meter-tall galley dated to the century. These 34 boats are arranged in the exhibition layout we have proposed, parallel to each other and with their noses pointed at the Bosphorus in



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Istanbul. Looking at the structure from the Bosphorus, he sees a large boathouse where sleds lie out of his eyes. If you look from the museum to the Bosphorus, what you see is a dock: the final supply of a fleet waiting to be opened is being made. (interview sections obtained from documents sent by Teğet Architecture)

- The circulation diagram of this building is very clear. The entrance opposite the bazaar is very obvious. When you enter from there, the view pulls you toward the Bosphorus, then you visit the boat gallery and a large ramp takes you upstairs. When you are traveling, you look at the things you have looked at from different levels and angles again. This time you are looking at the boats you are looking at from the ground from above, and from one side you see those on the top floor. When you walk around that floor and go all the way to the end, you cross the bridge and come to the upper floor of the registered building. There will also be a lot of small objects in it, such as clothes, models, and books. From there, when you go downstairs by a staircase, you go back to where you started from the passage on the boulevard side. It has a closed-circuit circulation resembling a three-dimensional spiral. (<https://xxi.com.tr/i/tersaneyeyokunen-muze-binasi>).
- When we are trying to plan and design a little bit about the problems experienced with the employer, the relationship that we think the Maritime Museum should establish with the city, employers are operators, and their habits are also important here. If part of the energy we spend while these buildings are being realized is in the design process, part of it is to convince the building owner of this relationship. For example, the Maritime Museum is an institution operated by the Navy, which is actually trying to civilize on the one hand. As we all know, there are security problems in the country. (interview sections obtained from documents sent by Teğet Architecture).
- Another important point is that the facade of the museum can be reached without any fence or wall. In order not to build a fence, we tried to explain our problem to every incoming commander starting from scratch and we accomplished a difficult thing. During the period from the competition to the construction of the museum, a hotel was built next to it. We suggested to them to connect the square in front of the museum with the place in front of the hotel, but we couldn't. They pulled a wall together and put their Decking behind it. However, if it had presented integrity, it would have been interesting, and it would have turned out to be an advantageous use for the hotel. (<https://xxi.com.tr/i/tersaneyeyokunen-muze-binasi>)
- Someone from Mimar Sinan University takes measurements with solar measuring instruments while doing his military service there. After that, he wrote an article on "the negative effects of daylight on the inventory at the exhibition" and mentioned the daylight coming to the nose of the boats and sent it to the magazine of the Chamber of Architects. So we suggested that he meet with us because the article was scientific in that way; it was a scientific-looking article with light graphics, etc. next to it. We wanted to meet with the author to develop it, but it didn't happen. Then one day when I saw the article in another magazine of the Chamber of Architects, I wrote a short text and put the title "Positive Effects of Sunlight on Marine Museum Inventories". We have oriented the mass of the building according to daylight, it provides protection; it also has protection on the roof, but they did not make the sensor-based sunscreens that we



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recommended for the facade, they did not apply the UV values that we consider appropriate for glass. (interview sections obtained from documents sent by Teget Architecture)

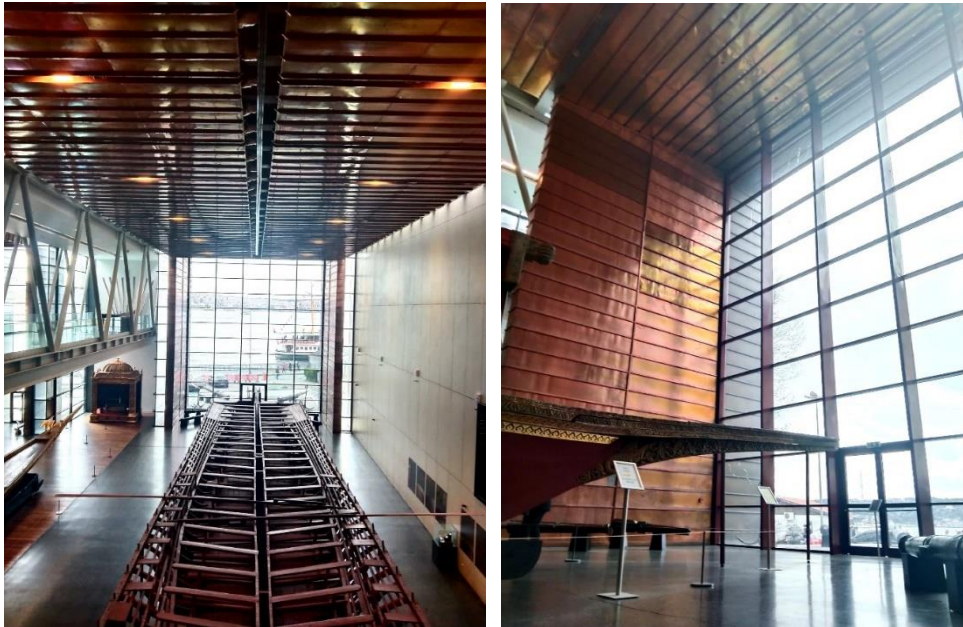


Figure 10. Istanbul naval museum photos (from the photo archive taken by the author)

In order to evaluate the building, employees and officers who accepted were interviewed, and feedback from the people who used the building the most was received. The officers declined to give their names because of the institution they work for. However, the fact that the views discussed on the important points of the maritime museum are identified and it is seen that there are different points of view on these issues enriches the understanding of the project.

- The first example that can be given to these views may be some points that officer 1, who participated in the interview, emphasized. One of these points is that cracks appear under the 58-ton large reign boat located at the entrance of the boathouse. Even if the cracks are considered to be superficial, no care is taken to ensure that these cracks do not widen more or that the minor difference in level can be fixed.



Figure 11. Istanbul Naval Museum ground floor (from the photo archive taken by the author)



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- The comment of another officer who participated in the interview is a comment criticizing one of the reasons why the museum was liked by the main jury. This interpretation, which looks from a different perspective, is that the feeling of curiosity beyond the walls in the museum, the feeling of progress by wondering about the next gallery, is damaged by ensuring visibility in the new museum building. The same officer also believed that the visibility of the ground floor, without columns and walls, causes a visual mess due to the steel structure carriers located on the mezzanine floor.



Figure 12. Istanbul Naval Museum ‘visibility design’ in the exhibition of the old building and the new one (from the photo archive taken by the author)

- The opinions of the third officer who agreed to participate in the interview are not an architectural interpretation, but an issue that makes it difficult to control the order between the visitors and the reign boats. The officer emphasized that the reign boats are not enough to be protected by being surrounded by metal ropes, which museum visitors can touch. He considers that the reign boats are intertwined with the circulation network in the museum exhibition and the ‘accessibility’ of boats, is considered as an obstacle to the officer who is responsible for the protection of the reign boats. The comment of the officer who works in one of the relevant offices and agreed to participate in the interview is that providing access to the upper floor of the boathouse only by the ramp is not suitable for the elderly and disabled. He emphasized that some people have been witnessed returning even after buying their tickets for this reason.



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Figure 13. Istanbul Naval Museum ramp in new building circulation (from the photo archive taken by the author)

- Along with noting the very different interpretations from each other and examining the versatility of the decisions made in the design of the maritime museum, there is a similar opinion received from most of the people who participated in the interview. This view is the slight sway felt in the new building when the ships at sea dock firm on the Beşiktaş shore since the land on the coast is built on the made ground. Some of the officers are concerned about the earthquake resistance of the building and express that they are more prone to shaking compared to the old building.

The preference for steel structure in the construction of the building was seen as the most suitable option for earthquake resistance and coping with the filling/made ground. In this case, although the durability of the new building may seem insufficient to prevent slight fluctuations in the building, it is observed during the research on design and construction stages that the necessary structural work is carried out.

4. CONCLUSION and RECOMMENDATIONS

The Istanbul maritime museum competition is a project that has been advanced in many ways and has been made with great effort due to a construction process that requires minimal movement of reign boats on land. It is seen that the correct establishment of the relationship with the old exhibition building and the placement of the reign boats in the new building with the correct designs were important architectural decisions in the competition. Thanks to the correct design decisions made by Teğet Architecture, the Istanbul Maritime Museum has reached its current state, and the benefits of not putting up a fence around it for protection, playing a wide, crowd-relaxing role in public and on the street can be seen to this day. The fact that the Maritime Museum has never approached the registered building with its two-story mass and has fallen to a single floor on the boulevard side shows that it is a supportive element by slowly merging with the structure in the background while bringing the structure to the foreground. Teğet Architecture has successfully brought to the fore the old exhibition building surrounded by the Barbaros Statue and Tomb, the Sinan Pasha Mosque. On the side of Besiktas Square, Teğet Architecture successfully solved the spiral circulation system constructed inside



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by connecting the two buildings with a transparent bridge. A clear understanding of the points that are important in the process of the Istanbul maritime museum architectural competition, the list of needs, and the features requested from the competition project in the specification makes an important contribution to the development of the project. The creation of a structure that can provide access to the land without damaging both the sultanate boats and the old exhibition building and the ability to provide the most suitable way of navigation for the museum visitor is the success of the project. Understanding and supporting the development of architectural project competitions with this project is one of the goals of this article, but it is desirable to be a stepping stone to future research.

Thanks and Information Note

I offer my special thanks to Prof. Cüneyt Kurtay, who supported and guided the process in the analysis and interpretation of the Istanbul Naval Museum article; to Teğet Architecture, for sending the relevant documents digitally and to contribute to the development of the article; to the work of the archives that play a role in finding important competition documents such as specifications, list of requirements.

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A COMPETITION JOURNEY: TURKISH REPUBLIC PRESIDENTIAL SYMPHONY ORCHESTRA CONCERT HALL AND CHOIR STUDY BUILDING

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ABSTRACT

This study examines the construction process of the Turkish Republic Presidential Symphony Orchestra Concert Hall and Choir Study Building, also known as CSO, a competition project that took 28 years to bring into use. The tender for the competition, which was opened in 1992, could only be made in 1995. The opening of the building, whose architects are Semra Uygur and Özcan Uygur, was held in 2020. From the competition stage to the tender process and from there to the completion of the construction, the process has been stopped for many different reasons. For this reason, problems occurred in the structure, but these problems were overcome with design decisions. Interviews were made with the architects of the project and the site manager to describe the process. In addition, printed sources archived by the architects of the project were used. Incorporating evidence from reviews, personal correspondence, and newspapers, this study points up problems encountered during the process and architectural solutions developed. As a result of the examination made specifically for this project, it has been revealed the architectural competition projects have undergone radical changes and transformed until the construction is completed.

Keywords: Architectural Competition, Construction Process, Cultural Heritage, Architectural History, Pneumatic.

1. INTRODUCTION

This study presents content related to studies conducted within the framework of the "Special Topics in Architecture" course as part of the Master of Architecture program at Başkent University. Within the scope of the course, the journeys of architectural competition projects, whose implementation phase has been completed, are examined, highlighting the differences between the award-winning competition project and the completed construction project. In this context, throughout this study, the processes from the competition phase to the completion of construction of the Presidential Symphony Orchestra Concert Hall and Chorus Working Building, which won first prize in the 1992 competition but was completed after 29 years, have been scrutinized.

The Turkish Presidential Symphony Orchestra has been in existence since 1826, making it one of the world's oldest orchestras. This historical orchestra, nearing its 200th year, was relocated to Ankara on April 27, 1924, under the orders of Mustafa Kemal ATATÜRK. It became a



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settled symphony orchestra in Ankara with the aim of promoting, introducing, and fostering polyphonic music in Turkey, as well as performing the works of Turkish composers abroad (Ak, 2021; "CSO Hakkında", 2022).

Due to the inadequacy of the first concert hall opened in 1960, there arose a need for a new building. In 1992, a national competition was organized, marking the beginning of the project and construction process for the new concert hall (bi-özet, 2020).



Figure 1. First Concert Hall (SALT Archive)

The Presidential Symphony Orchestra Concert Hall was born as a result of the quest for a concert hall befitting the capital of the Republic of Turkey. Just as the Sydney Opera House represents the city of Sydney and Australia on a global scale, it was believed that an iconic and symbolic structure was necessary. To undertake this prestigious project, a national architectural design competition was organized in 1992. The project, designed by Semra UYGUR and Özcan UYGUR, received the first prize among 46 competing projects.

The concert hall has been designed as a composition formed by the combination of earth, water, and green elements. The concert halls, foyer, and other units of the complex are planned to be enclosed by an artificial lake. The masses of the concert halls and the foyer are compressed and interconnected, creating a closed valley. The transparent foyer mass rising from within the lake between the concert halls marks the axis between two significant landmarks of Ankara, Anıtkabir and Ankara Castle. All geometric forms exist as a product of a symbolic approach.



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Figure 2. Presidential Symphony Orchestra Concert Hall and Choral Rehearsal Building. view from the foyer mass towards the axis of Ankara Castle. (Arkitera Archive)

The construction of the building utilized the pneumatic (membrane) formwork technique due to the unique shapes of the structures, namely, ellipsoidal (egg-shaped) and spherical halls. This structural system was used for the first time in Turkey. It was executed by Turkish engineers and workers under the supervision of an American company. After placing the membrane on the foundation, it was inflated with compressed air. Subsequently, polyurethane was sprayed inside the formwork for insulation, and "shotcrete" was applied to the exterior of the formwork. The thickness of the concrete in the ellipsoidal hall was 52 cm, while in the spherical hall, it was 30 cm, adjusted according to acoustic requirements. The use of the pneumatic formwork system for the first time in Turkey brought about implementation challenges. As a result, architectural decisions were made to ensure that the form would reach the intended shape.

Another challenge faced during the construction process was the fact that the project site was located on an old riverbed. Even during the foundation pouring, there were rises of up to 1 meter in the foundation due to underground water. However, especially during the project's suspension, no intervention was made, causing the construction site to be submerged underwater. Due to a lack of planning and demand, the construction progress proceeded unusually slowly, and after excavation work in 2004, when construction was halted for an extended period, the underground water beneath the site turned into a lake.

All these challenges were overcome through the design decisions made. This complex, with a total construction area of 62,547 square meters, has opened its doors after a 29-year journey as a new venue for lovers of Symphonic Music, Turkish Classical Music, Turkish Folk Music, Polyphonic Choir, and Folk Dances, and it is now actively serving the community.

2. MATERIALS and METHODS

In this study, interviews were conducted with the architects of the project, Semra UYGUR and Özcan UYGUR, their daughter Deniz UYGUR, who is also an architect, and the construction site supervisor Vedat OĞUZMAN through written and verbal channels. Additionally, as a result of these interviews, printed resources archived by the project architects were shared with me.



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This research, while conducting the examination, presents the problems encountered during the process and the architectural solutions developed, incorporating evidence obtained from reports, personal correspondence, and questions conveyed via email, newspapers, and magazine articles.

3. FINDINGS and DISCUSSION

The full name of the building is "Atatürk Cultural Center Presidential Symphony Orchestra and Choir Rehearsal Buildings," commonly known as CSO. It was conceived as a prestigious structure to be built within the Atatürk Cultural Center Complex and was opened to architectural ideas through a national competition organized in 1991 under the auspices of the Ministry of Public Works and Settlement of the Republic of Turkey (now known as the Ministry of Environment, Urban Planning, and Climate Change).

In commemoration of the 100th anniversary of the birth of the founder of the Republic, Atatürk, and as a symbol of the Republic, a decision was made to construct an Atatürk Cultural Center Complex. To enable the construction of the complex, Law No. 2302 was enacted on September 23, 1980. This law defined the boundaries of the Atatürk Cultural Center area.

The boundaries of this area consist of 5 zones as indicated in the diagram included in Law No. 2302's annex. The decision and authority for the construction of all buildings within the Atatürk Cultural Center area were granted to the National Committee. The "1/5000 Scale Atatürk Cultural Center Area Master Plan," approved by the Ministry of Environment, Urbanization, and Climate Change of the Republic of Turkey in 2001, is in accordance with the form deemed appropriate by the National Committee within the Presidency.

In this plan, the 1st Zone is designated as a "Culture and Recreation Area," encompassing the Old Hippodrome Area and the Atatürk Cultural Center Building, along with the unused State Opera and Theater Building and Congress Complex Project. The 2nd Zone in the plan is identified as a "Sports Area," housing the 19 May Stadium, Atatürk Indoor Sports Hall, and Arena Indoor Sports Hall. The 3rd Zone covers the Youth Park area and is designated as a "Culture and Entertainment Area."

The 4th Zone is categorized as an "Artistic and Cultural Area," containing the Presidential Symphony Orchestra building and other facilities such as the CerModern art gallery, which has been restored by Semra UYGUR and Özcan UYGUR, and the Selim Sırrı Tercan Sports Hall. The final zone, the 5th Zone, is designated as a "Historical Area." In this zone, the Republic Museum, the Independence War Museum, and the first and second Parliamentary buildings, located between Ulus Square and Youth Park, are situated.

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Figure 3. Atatürk Cultural Center area region boundaries. (Ministry of Environment, Urbanization, and Climate Change, Republic of Turkey, 2014)

By the decision of the National Committee dated December 14, 1990, the project to design the Presidential Symphony Orchestra Concert Hall, Multipurpose Halls, and working spaces for Turkish Classical Music in the 4th Zone of the Atatürk Cultural Center area was assigned to the Ministry of Public Works and Settlement.

Subsequently, the Ministry of Public Works and Settlement organized a national, single-stage design competition to obtain the projects for the Presidential Symphony Orchestra Concert Hall and Chorus Working Buildings. The jury members for this competition were prominent architects of their time, including Orhan DİNÇ, Doğan TEKELİ, İlhami URAL, Nejat ERSİN, Doruk PAMİR, and Umur ERKMAN, along with Civil Engineer Ali TERZİBAŞOĞLU. The specifications prepared by the jury members were comprehensive, providing a thorough overview of both the program and the data related to the location.



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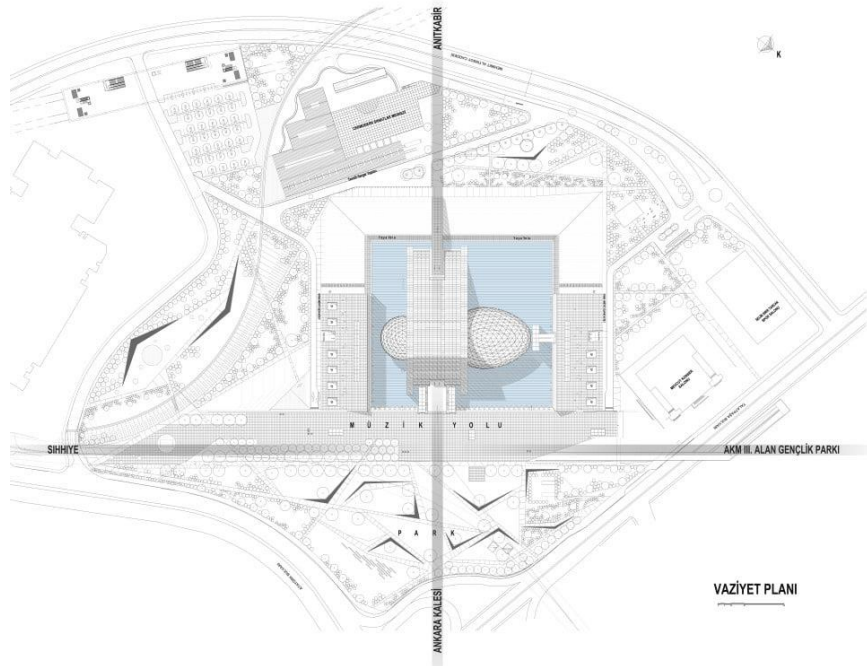


Figure 4. Site plan. (Uygur Architecture Archive)

"As a competition brief, I believe that it is still the best competition specification we have ever encountered, even though 30 years have passed since then. This is because the competition brief clearly and explicitly articulated what was expected in terms of the city and the building."

Semra UYGUR

The most crucial element we need to address first when discussing the competition is the competition brief. As conveyed by the project's architects, the competition brief for the Atatürk Cultural Center Presidential Symphony Orchestra and Chorus Working Buildings (See Appendix-1) played a pivotal role in shaping the project by providing information and data about what was required. When the specification content is examined, it begins with explanations about the competition area.

According to the information presented in the specification, the 4th Zone is described as an area where Atatürk Boulevard, which predominantly serves as a protocol road in Ankara, intersects and offers the most beautiful perspective of Anıtkabir. Furthermore, in this regard, it is recommended that the development in this area should consider leaving green buffer zones towards the direction of the Palace of Justice and the traffic intersection, with the sports hall and the area near the old CSO building in mind. Ensuring continuity between the Youth Park green area and the green areas to be arranged in the 4th Zone is also suggested.

"This actually indicates the expectation of green area and pedestrian pathway connectivity in Ankara."

Semra Uygur

In the competition, it was stated that the main objective was to find the conceptual ideas for a structure that would symbolize the contribution of the Republic of Turkey to "Universal



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Culture" and reflect the current level of "Turkish Architectural Art." It was aimed to create a contemporary and enduring cultural monument while also promoting the fine arts.

In terms of massing, the design of the concert hall and chorus working buildings, either as separate masses or together, with an emphasis on their ability to function independently, was left to the discretion of the participants, taking into consideration their relationships with the surroundings and urban data. Additionally, even for the parking facilities, it was suggested that they should be designed in a capacity and form that could meet the needs of the immediate environment, including both open and closed, limited, and general-purpose areas when necessary. It was also specified that the entrances to the service and parking areas should be provided from Talatpaşa Boulevard via the road that surrounds the competition area along the railway on the western side.

Subsequently, the competition requirements were detailed. Participants were requested to provide a site plan, floor plans, sections, elevations, a model, perspectives, an architectural description report, a civil engineering description report, a mechanical engineering description report, an electrical engineering description report, and an acoustic report. Each of these documents was specified with its details.

Some of the important points regarding these documents included the requirement to show prevailing wind, landscape, and north direction indicators in the same location collectively on the site plan. The existing conditions (boundaries, roads, etc.) were to be depicted as zoning lines, and the total construction area was to be written in a suitable place on the sheet.

For the floor plans, they requested that the outer dimensions be shown towards the outer building façade, with block dimensions on the first line and load-bearing axes on the second line. Blocks were to be labeled, and the names and orientations of the units they contained were to be indicated. It was also specified that all buildings would be leveled with the finished floor level of the main entrance set at 0.00. Ground floor plans were to include landscaping as needed, with room names specified in writing, and even furnishings added to the spaces as deemed necessary. All of this data highlights the comprehensiveness of the specification, encompassing every detail.

The competition results, as specified in the competition brief, were determined through the jury evaluation held on October 5, 1992, and were announced in a one-day publication in Ankara and a two-day publication in Istanbul. Additionally, the jury report was sent to the relevant professional associations and to the addresses of all participants who had obtained the competition specifications.

Projects that did not win awards were returned to their respective owners. The rights to the winning projects and honorable mentions were secured by the ministry. According to the competition brief, the ministry would proceed with the implementation projects and professional supervision services for the first-place winning project if the feasibility of the first-selected project was approved by the jury.

There is a part in the competition brief that can be seen as the cause of delays in implementation. According to the specification, the commencement of the implementation project was contingent upon the project allocation being included in the annual investment program and budget. If the project allocation was not included in the annual investment program and budget, the ministry would have the discretion to decide whether or not to proceed with the



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implementation projects. If the project allocation was included in the annual investment program and budget and the project's needs had not significantly changed, the ministry would have the implementation projects carried out by the project owner selected according to the provisions of this specification and its attachments.

According to Özcan UYGUR, the foundation of the project's backstory was laid in the Turkish architectural scene in 1991. Özcan UYGUR mentions that both the Chamber of Architects and the Turkish Association of Freelance Architects put forth significant efforts during that time, and this was widely covered, even in newspaper columns. He also emphasizes that the architectural environment of that period played a crucial role in shaping the genesis and foundation of this competition.

When they embarked on the competition, they initially conducted research to understand the conceptual landscape globally and sought inspiration from two projects that particularly influenced them on a conceptual level. The first was the International Design Competition for the Alexandria Library, and the second was the International Architectural Design Competition for the Acropolis Museum. These competitions, especially the one where Nicoletti took the first place, provided architects with valuable clues and insights for framing their ideas.

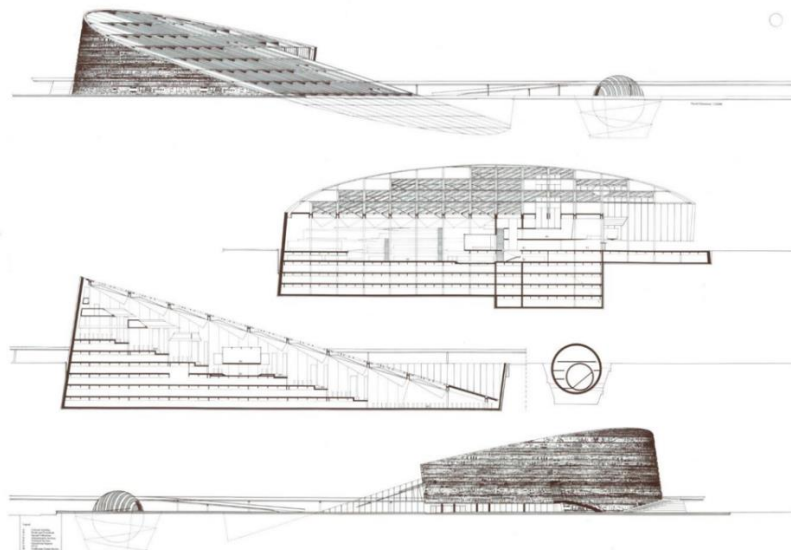


Figure 5. Sections of the Alexandria Library project. (Ragheb, 2016)

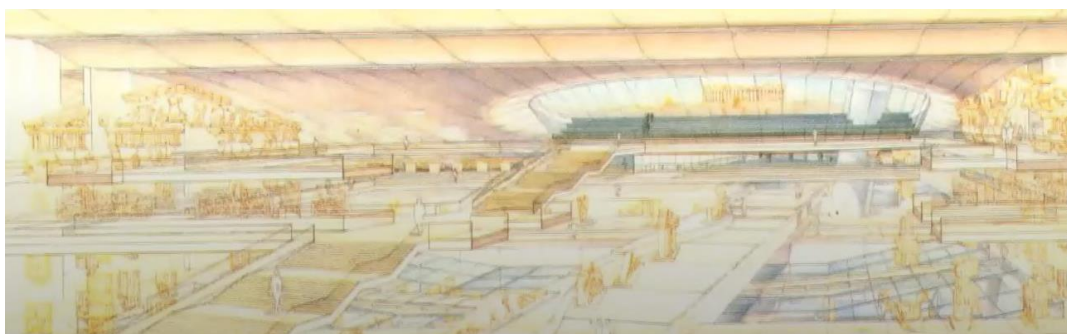


Figure 6. Sketch perspective of the Acropolis Museum project. (Uygur Architecture Archive)



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During the period when the competition was launched, the area was being used as subway construction sites. This area later encompassed a total of 145 acres, including the Cer Workshops, for which Uygur Architecture conducted restoration work.

Semra UYGUR mentioned that during the period when the competition was initiated, the area was being used as subway construction sites. This area later encompassed a total of 145 acres, including the railroad yard, for which Uygur Architecture conducted restoration work. When looking at a 1/5000 scale map, they realized that the area was situated at a point where it connected the axis between Anıtkabir and Ankara Castle. They emphasized that this realization was crucial in establishing the relationship between what was required in the competition brief.

When they realized this, they wondered whether the orientation of Anıtkabir towards Ankara Castle was accidental. They mentioned that in the Anıtkabir library, they found a typewritten and handwritten note-covered unpublished book draft by Orhan ARDA, recounting the story of the construction of Anıtkabir. They were allowed to make photocopies of it. Upon reading it, they learned that the specific orientation of Anıtkabir's mausoleum towards Ankara Castle axis was a recommendation from the jury members, particularly Paul Bonatz's suggestion. During its construction, Orhan ARDA and Emin ONAT had adjusted the mausoleum in this direction while preparing the implementation projects based on this recommendation.

"One day, I will surely die; my nation can bury me wherever they wish. However, I would like to see a glorious Turkish flag waving in front of my grave at all times."

Mustafa Kemal ATATÜRK

Despite the minarets of the Melike Hatun Mosque in Ulus today obstructing the line of sight, the window in Atatürk's mausoleum precisely frames the Turkish flag waving atop Ankara Castle. According to Semra UYGUR, this piece of information held great significance for them.

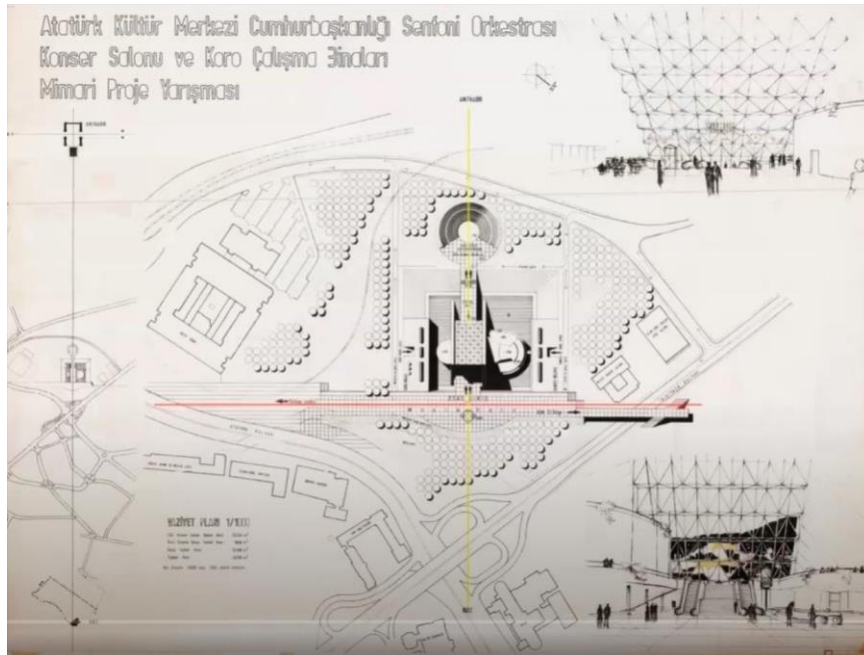


Figure 7. Competition 1st sheet. (Uygur Architecture Archive)



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In the first sheet of the competition, the yellow axis is marked as the axis connecting Anıtkabir to Ankara Castle. On the other hand, the red axis signifies the physical connection of Atatürk Boulevard mentioned in the competition specifications to Gençlik Park through the bridge over Talatpaşa Boulevard, as requested.

The content of the competition includes a 2000-seat concert hall and a 500-seat chamber music hall. On the right side, there are office units for the Presidential Symphony Orchestra staff. On the left side, choir workspaces have been provided, including Turkish folk music, Turkish classical music, polyphonic choir, and Turkish folk dance.

The concept here is to create a stopover point at the point where the castle and Anıtkabir face each other while fulfilling these functions, to unite the areas of the Atatürk Cultural Center, and to establish tranquil, serene, self-contained workspaces around a crater lake within these areas.

"... This proposal is conceived as a step that connects the Atatürk Cultural Center areas. In the competition area, which is the only open space on Atatürk Boulevard providing perspective to Anıtkabir, a music center has been designed that harmonizes with earth, water, and greenery (without compromising this view and losing the structure)."

Architectural Description Report

In order to accomplish this task, the building has been lowered by 8 meters from Atatürk Boulevard. This way, the building could make itself visible, and the visibility of Anıtkabir from Atatürk Boulevard has not been obstructed.

"The halls and foyer have been preserved within a crater lake, framed by the complex's other units and the surrounding terrain. ... With the rise of the foyer's central Euclidean and iconic form, this cluster of buildings joins in the dialogue between Anıtkabir and the Castle. The main mass of the concert hall legitimizes its presence within the crater lake and lifts its head as if to say, 'I am here.' The visual impact of the structure, surrounded by water, is enhanced by reflections.

This designed music center is a meaningful urban space that acknowledges and contributes to the deliberate dialogue between Anıtkabir and the Castle through architectural design decisions."

Architectural Description Report

At this point, it is necessary to mention the jury members. The competition was evaluated by a jury consisting of prominent figures in Turkey at that time. The jury panel, chaired by Doğan TEKELİ, included Orhan DİNÇ, Nejat ERSİN, Doruk PAMİR, Ali TERZİBAŞOĞLU, İlhami URAL, and Nuran ÜNSAL.

The report on the project selected by the majority vote of the jury includes the following notes:

"... The proposed project has approached the task not as a structure with a design language that could be valid for a specific time period but as a city-scale, enduring symbolic gesture, making it stand out with this attitude. ..."

The timeless design approach that also contributed to the prominence of the project, as mentioned by the jury members, has ensured that the construction, which took 28 years, as the jury members have stated, never becomes outdated.



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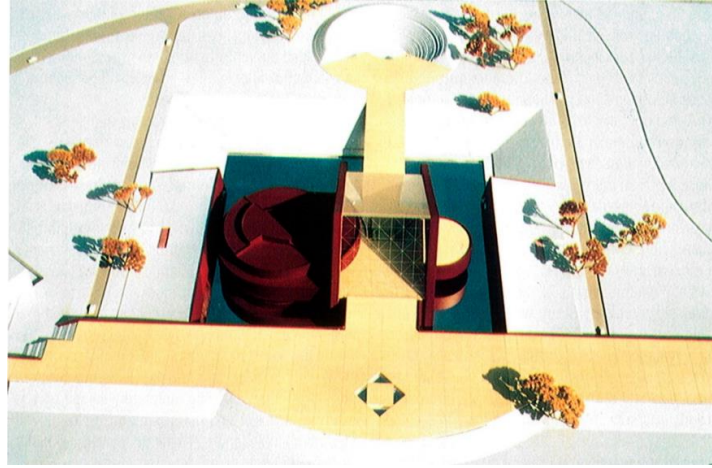


Figure 8. Competition model. (Uygur Architecture Archive)

During the implementation project phase, the idea of separating and distinguishing the adjacent masses of the building located at the lowest level of the region was developed. The circularly shaped flat-roofed cylindrical masses in the competition project have been replaced by two independent shells in the form of an egg and a sphere.

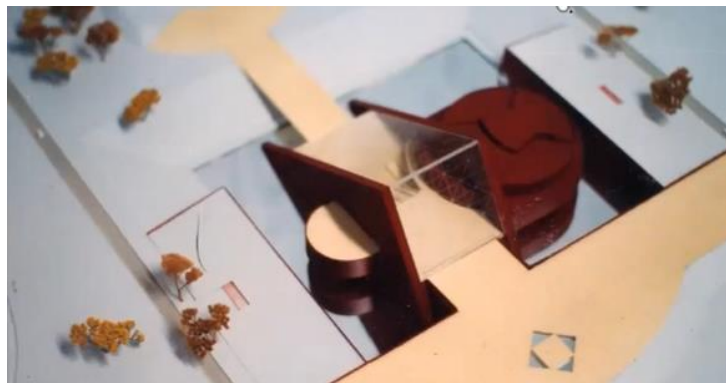


Figure 9. Competition model. (Uygur Architecture Archive)

After extensive work, the concrete shell structures of the Symphony Orchestra Concert Hall and Chamber Music Concert Halls, which are unique in the world, are constructed in Turkey for the first time using a pneumatic formwork system.

Along with the shell forms, the layout of the concert hall, which was deemed acoustically insufficient in the jury report and requested to be redesigned, has also been updated. At this stage, the architects mentioned that they took inspiration from the Berlin Philharmonic Orchestra Building and believed that the hall had a shape similar to an egg. They worked in collaboration with an acoustic consultant and determined that the egg shape was the most acoustically optimal form.

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Figure 10. Construction site photograph. pneumatic formwork. (Uygur Architecture Archive)

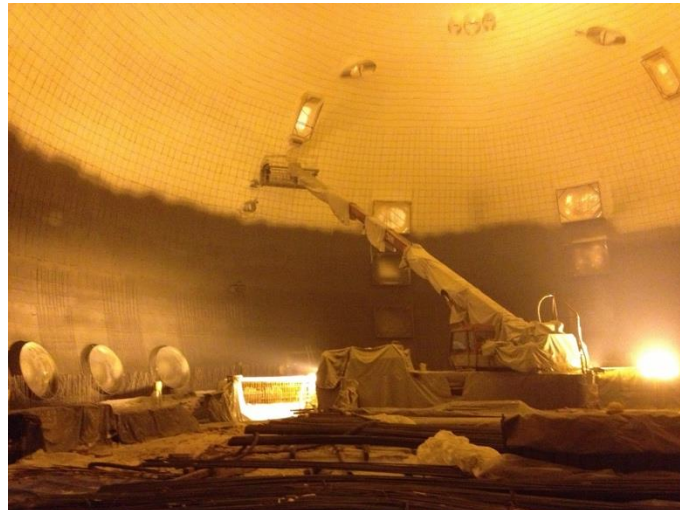


Figure 10. Construction site photograph. from inside a pneumatic mold. Concrete shell formation using spray technique. (Uygur Architecture Archive)

The project, which began with an architectural design competition in 1992, was awarded a contract in 1995 before the design was fully completed. Consequently, the construction complex, whose foundation was laid in 1997, was repeatedly postponed until 2014 due to insufficient funding. Due to a lack of planning and demand, the construction progress proceeded at an unusually slow pace. In 2004, after excavation work, the construction was halted for an extended period, and the underground water beneath the site turned it into a lake.

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Figure 11. Groundwater resurfacing during the pause period. (Uygun Architecture Archive)



Figure 11. Groundwater resurfacing during the pause period (Uygun Architecture Archive)

Thanks to the personal efforts of the Minister of Culture at the time, the construction site, which had come to life in 2008, made significant progress even with limited funding for about 5 years. However, in 2014, with the depletion of all funds, the construction site fell into a deep slumber lasting for 3 years.

The construction, which had its turnkey tender in 2017, was rushed to completion at a rapid pace. However, this complex, which had been neglected by bureaucrats for almost 30 years, was turned into promotional material when it reached the final stretch. It was attempted to be opened hastily without completing the fine work, acoustic tests, and landscaping project. The facility announced to the public on December 3, 2020, was opened as if it were finished. Subsequently, it was closed, citing the pandemic, and construction continued.

During this 29-year period, there were changes in leadership with 5 Presidents, 10 Prime Ministers, and 20 Ministers of Culture.

4. CONCLUSION and RECOMMENDATIONS

Within the scope of the Master of Architecture at Başkent University's Department of Architecture, the course with the code MIM531, titled "Special Topics in Architecture,"



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explores the stories of projects constructed as a result of architectural design competitions. In this context, the report examines the National Architectural Design Competition for the Presidential Symphony Orchestra and Chorus Working Buildings, which is also known as the Atatürk Cultural Center. The report delves into the competition process of the project and the subsequent 28-year construction period, investigating the challenges encountered during this period and how these challenges were overcome through design decisions.

From the moment Semra UYGUR and Özcan UYGUR's project was selected as the winner, it took five years before construction began on the Atatürk Cultural Center, Presidential Symphony Orchestra, and Chorus Working Buildings. During the implementation phase, the project changed, resulting in its current form. Although no revisions were requested, the architects made changes to enhance the project. According to the architects, this period was a time when they questioned themselves, wondering if "could it have been better," and they made revisions to what they could.

A groundbreaking decision was made in Turkey, where a pneumatic formwork system was used to construct the concert hall masses. Since this was the first time such a method was attempted in Turkey, the contracting company sought consultancy from an experienced American firm. However, the project progressed with highly skilled Turkish engineers and workers. Moreover, using this method, the egg-shaped three-dimensional structure quickly took shape. While the architects claimed there were no issues, Vedat OĞUZMAN, the site manager, noted that due to the massive size of the structure, there were deformations in its form during the construction process. Three-dimensional scans were conducted, precise measurements were made with machines working by point cloud, and substantial amounts were spent. The existing structure was scanned and digitized, revealing a subtle 1.5-meter depression on top of the sphere, which was difficult to perceive due to the weight of the concrete. When there was a downward sag, it was observed that there was an inflation of 30-40 cm on the sides.

In the competition project, the cladding of the concert hall masses was designed to be stainless steel, but it was foreseen that the cladding, which was planned to be curved from three layers, would pose problems during production due to its large size. Therefore, "flat" frosted glass, which was manufactured in dimensions that would not alter the egg and sphere qualities, was used instead. Each glass size was determined individually through parametric work. Then, by adjusting the leg lengths of the facade's construction, the 1.5-meter difference was bridged, and the desired form of the structure was achieved.

Another challenge during the construction process was the fact that the project was situated on the site of an old riverbed. Even during foundation pouring, elevations of up to 1 meter were observed in the foundation due to groundwater. However, especially during the project's suspension, the site could not be intervened, resulting in the construction site being submerged in water.

All of these challenges were resolved through design decisions. This complex, with a total construction area of 62,547 square meters, serves as a new working and meeting point for lovers of Symphonic Music, Turkish Classical Music, Turkish Folk Music, Polyphonic Choir, and Folk Dances, following a 29-year journey, and is now actively in service.



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Thanks and Information Note

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SUGGESTIONS FOR HOSPITALS' INTERIOR DESIGN STRATEGIES WITH EVIDENCE-BASED DESIGN (EBD) APPROACH: PATIENTS POINT OF VIEW

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ABSTRACT

This research aims to study hospital design strategies with an Evidence-Based Design (EBD) approach and to suggest a method to create an efficient design guideline for the interior architecture field. For the interior architecture field, user's needs, attributes, and desires are the focal issues. This research is focusing on patients as a target user group. Patients' perceived quality of care depending on the design strategies of the hospitals will be considered in the guideline method suggestion. This study is review-based and it is conducted to evaluate the evidence for healing properties of hospital environments focused on key interior design features of hospital buildings such as; infection control (materials), reducing noise levels, improved wayfinding, improved thermal comfort, improved visual comfort, improved physical comfort, access to nature and future based design considerations etc. These features are categorized under five criteria according to affinity diagramming; safety issues, comfort issues, accessibility issues, social issues, nature related issues. EBD has a significant role in the planning and design of hospitals as a result, this study contributes to the field since it suggests a guideline after discussing all related literature deeply. The Systems Research Organizing Model (SROM) is used for creating the design guideline by considering the decision-making process.

Keywords: Evidence-Based Design (EBD), Healing Properties of Hospital Environments, Person-Environment Relationship, Affinity Diagramming, Systems Research Organizing Model.

1. INTRODUCTION

As part of hospital design's planning process, there is a rising demand for Evidence-Based Design (EBD) concepts that are effective in patient care in terms of "healing environments". However, the criteria are not fully stated as a guideline for interior architects, architects, and designers for efficient use of EBD features in hospital design to enhance person-environment relationships and allow hospitals to be healing environments for patients. This study is aimed to be a unique and contributive study in terms of defining the EBD features in the decision-making process of design under five main categories; safety issues, comfort issues, accessibility issues, social issues, and nature-related issues by using a descriptive study based on affinity diagramming of literature review and open-ended questions based interview with 30 participants.

Problem Statement:

As part of hospital design's planning process, there is a rising demand for EBD concepts that are evidently effective on patient care in terms of "healing environments". However, the criteria are not fully stated as a guideline for interior architects, architects and designers for efficient

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use of EBD features in hospital design to enhance person-environment relationships and allow hospitals to be healing environments for patients. This study is unique and contributive in terms of defining the EBD features in the decision-making process of design under three main categories; safety, comfort, and accessibility by using a descriptive study based on affinity diagramming of literature review. This study focuses on patients' points of view however, medical staff, administrative staff, and visitors are also other target user groups and in future studies, it will contribute to focus on these user groups as well.

2. MATERIALS and METHODS

Evidence Based Design (EBD)?

EBD is a scientific approach that focuses on the use of data acquired in order to influence the design process in healthcare facilities like hospitals. EBD aims to measure the physical and psychological effects of the built environment on its users (Zimrig et. al., 2008). EBD is an influential approach on person-environment relationship especially in healthcare design field. EBD is an approach to create efficient healing environments for healthcare facilities. EBD provide the focus on how designs can be best utilized to help patients recovery while providing safe environment for the staff allowing them perform better (Rafeeq& Mustafa, 2021), (Ulrich, 1997). Figure 1 illustrates the EBD theoretical framework with built environment variables and the outcome from the target user's point of view.

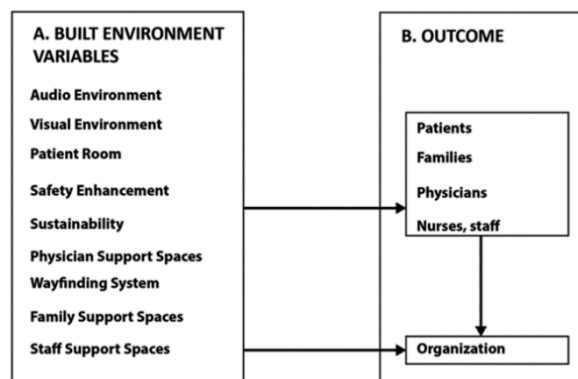


Figure 1. The EBD theoretical framework (Taken from Ulrich, 2004).

1. Healing Environments:

According to the World Health Organization (WHO) health is not simply the absence of disease, and hospitals have a great role in enabling physical, mental and social well-being (Rafeeq& Mustafa, 2021). Healing environments are multisensory settings. They engage the physical, emotional, spiritual, and social dimensions of the individual for the purpose of restoring and maintaining health and well-being (Ulrich, 2004). The healing environment is a term used to define the parameters that have a psychological and physical effect on the healthcare community, including staff, patients, and visitors (Rafeeq & Mustafa, 2021). A healing environment maximizes an individual's control over the environment, supports one's social network (i.e., thoughtful accommodations for families and visitors), and affords unrestricted access to nature and other positive distractions (Ulrich, 2000).



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I. Elements of EBD

- i. Connection to Nature (Windows, Skylights, Access to Garden or Terrace etc.)
- ii. Control
- iii. Acuity Adaptable Rooms
- iv. Distributed Nursing Stations
- v. Privacy (Single Patient Rooms)
- vi. Social Support
- vii. Positive Distractions (Socio-environmental Features like Music or Arts etc.)
- viii. Thermal Comfort (Air Quality etc.)
- ix. Visual Comfort
- x. Audial Comfort
- xi. Ergonomic Furniture and Arrangements (Socially Supportive, Comfortable, Flexible, etc.)
- xii. Wayfinding
- xiii. Building Layout
- xiv. Sustainable Design Features

(Huisman et al., 2012); (Jackson, 1991); (Malkin, 2008); (Mallock & Porter O'Grady, 2005); (Pati et al., 2008).

II. Relationship of EBD and Healing in Healthcare Design

Healthcare designers need to acknowledge that the main need for comfort is the critical path on the patient journey (Verdel & Todd, 2012). The need to provide an environment that makes the patient feel that they have privacy, a sense of security, safety, social area, and personal space. With EBD in the interior design process, the person-environment relationship is enhanced in hospital environments (Rafeeq & Mustafa, 2021).

- i. Person (Patient)-Environment (Healthcare Facility) Relationship
- ii. Reduced Pain
- iii. Reduced Stress
- iv. Reduced Depression
- v. Rapid Healing Process
- vi. Lower Medication Intake
- vii. Reduced Mortality
- viii. Improved Sleep Patterns
- ix. Improved Patient Experience



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III. EBD and Hospital Design

Hospices, elder care institutions, and hospitals are considered healthcare facilities. In this study, the focus is on hospital design. Hospitals are in general stressful places for patients and visitors mainly due to fear of death, pain, and noise. Therefore, providing a better healing environment would help them relieve the stress and would also improve the outcome (Verran et. al., 2012). This makes hospital design a complex mission that is not only limited to functional aspects but also encompasses physiological and social aspects. This task might be more critical when the design targets patients with restricted mobility.

3. Suggested Methods and Findings for Guideline Formation Process

Affinity Diagramming of Literature and Interview:

Japanese anthropologist Kawakita Jiro evolved the affinity diagram in the 1960s. The main aim of an affinity diagram is to generate, organize, and consolidate information concerning a product, process or design problem. Constructing an affinity diagram is a creative process that expresses ideas without quantifying them. The affinity diagram helps a group to develop its own system of thought about a complex issue or design problem. Table 1 shows the five categories; safety issues, comfort issues, accessibility issues, social issues and nature related issues and the related interior design features according to the affinity diagramming of the literature.

Table 1. Affinity diagramming of EBD for hospital design

DESIGN ISSUE CATEGORY	FEATURE 1	FEATURE 2	FEATURE 3	FEATURE 4	FEATURE 5	FEATURE 6	FEATURE 7
SAFETY ISSUES	Ergonomic Furniture	Acuity Adaptable Rooms	Wayfinding	Efficient Building Layout	Distributed Nursing Stations	Control	
COMFORT ISSUES	Ergonomic Furniture	Acuity Adaptable Rooms	Privacy	Social Support	Thermal Comfort	Visual Comfort	Audial Comfort
ACCESSIBILITY ISSUES	Efficient Furniture Arrangement	Efficient Vertical Circulation	Efficient Horizontal Circulation				
NATURE ISSUES	Openings like Windows, Skylights etc.	Access to Terrace, Balcony, Garden etc.	Sustainable Design Features				
SOCIAL ISSUES	Waiting Lounge etc. Public Areas	Social Distractions like Music, Arts etc.	Socio-et al Furniture Arrangements				



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Table 2. Participants of the selected hospital design

DEMOGRAPHICS	PATIENTS WITH CANCER DISEASE	PATIENT WITH COPD DISEASE	PATIENT WITH CARDIOVASCULAR DISEASE
Gender			
<i>Female</i>	5	5	7
<i>Male</i>	3	6	8
Age			
<i>18-24</i>	1	0	0
<i>25-34</i>	0	0	0
<i>35-44</i>	1	0	2
<i>45-54</i>	3	0	4
<i>55-64</i>	1	3	4
<i>65 and over</i>	2	8	5
Highest Level of Education			
<i>Middle School</i>	0	0	0
<i>High School</i>	3	7	6
<i>Undergraduate Degree</i>	4	4	7
<i>Graduate Degree</i>	1	0	2
Months of Treatment			
<i>Maximum</i>	26	38	52
<i>Minimum</i>	2	1	4
<i>Mean</i>	9.2	11.2	22.4

In this study affinity diagram is first used to categorize the interior design features of hospitals in terms of EBD. Then the second phase was to add the interior design features found in the interview with 30 participants related to hospital design. The interview was done in a hospital in Maltepe, İstanbul. All participants have some chronic diseases like cancer, chronic obstructive pulmonary disease (COPD) and cardiovascular diseases which means that they visit the hospital environment frequently. However, none of these diseases affect cognitive abilities so, that is why the demographic information is as shown in Table 2. Also, all participants have a minimum high school degree as an educational background.



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As shown in Table 3, after the interviews, the interior design features are increased. Since the target user group is hospital patients, their additions to literature review is very significant. The interview-based additions are shown in red color. The open-ended questions that lead the interview are;

1. Which design features will allow you to feel more safe?
2. Which design features will allow you to feel more comfortable?
3. Which design features will allow you to be more social?
4. Which design features will allow you to have a better mood?
5. Which design features of a hospital make you feel less stressed?
6. What is the most significant design issue during your hospital visits?
7. What is the most significant design issue if you need to stay in a hospital room?
8. Which design features or lack of design features make you feel nervous?

Table 3. Affinity diagramming of EBD for hospital design with the addition of interview results

DESIGN ISSUE CATEGORY	FEATURE 1	FEATURE 2	FEATURE 3	FEATURE 4	FEATURE 5	FEATURE 6	FEATURE 7	FEATURE 8
SAFETY ISSUES	Ergonomic Furniture	Acuity Adaptable Rooms	Wayfinding	Efficient Building Layout	Distributed Nursing Stations	Control		
COMFORT ISSUES	Ergonomic Furniture	Acuity Adaptable Rooms	Privacy	Social Support	Thermal Comfort	Visual Comfort Colors	Audial Comfort	Home-like
ACCESSIBILITY ISSUES	Efficient Furniture Arrangement	Efficient Vertical Circulation	Efficient Horizontal Circulation	Reachable Information Desk	Legibility	Non-slip Floor Materials	Handrails and Bars	Elderly-Friendly
NATURE ISSUES	Openings like Windows, Skylights etc.	Access to Terrace, Balcony, Garden etc.	Sustainable Design Features					
SOCIAL ISSUES	Waiting Lounge etc. Public Areas	Social Distractions like Music, Arts etc.	Socio-et al Furniture Arrangements	Atmosphere	Dignity			

As can be seen in the table there are new interior design features that are suggested by hospital patients. Their suggestions are also added because the focal point is target users' desires, attributes and comfort.

1. Reachable Information Desk (3 Participants)



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2. Atmosphere More Than a Hospital; Gift Shops, Flower Shops Etc. (2 Participants)
3. Dignity (12 Participants)
4. Homelike Environment (16 Participants)
5. Legibility of Place (12 Participants)
6. Non-slip Flooring (22 Participants)
7. Handle Bars (25 Participants)
8. Colors (25 Participants)
9. Elderly Friendly (18 Participants)

Decision Making Process in Design for Hospital Design

Developing a design guideline should be valid and efficient (AIA, 2006). For this reason, for the study some developed methods are used such as; decision making process and Systems Research Organizing Model (SROM).

1. Surveying
2. Investigating alternative course of action
3. Assimilating new information
4. Strengths, weaknesses, opportunities and threads (SWOT) analysis
5. Developing a plan
6. Developing a concept
7. Developing the design process
8. Expert judgement/consultation
9. Embodiment
10. Finalization

The process is illustrated in Figure 2.



Figure 2. Design development process stages and sub-stages (Figure 2 is Drawn by the Author).

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Systems Research Organizing Model (SROM)

Systems Research Organizing Model (SROM) is a fully justified model with four main elements: client, context, action focus, and outcomes. Feedback loops in the model reflect the interrelatedness of the core constructs and recognize the complex nature of the healthcare environment. It is a valuable tool for EBD by making sense of what is already known, providing a framework for future studies and synthesizing multiple studies to guide application to practice. Figure 3 illustrates the Interacting Constructs of SROM and Figure 4 shows SROM for this study.

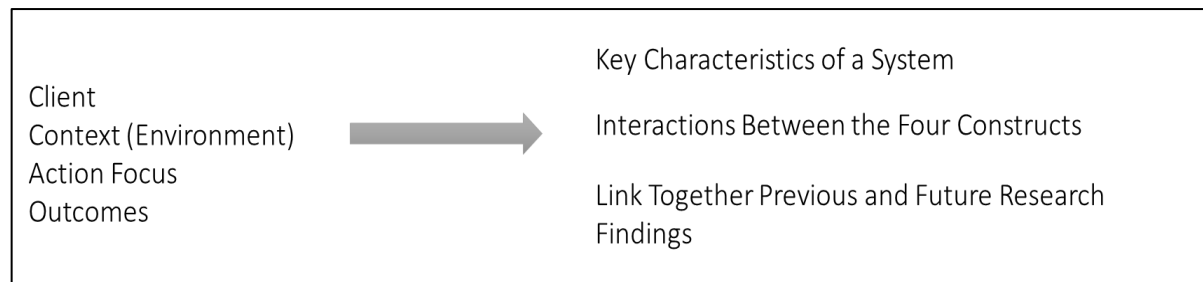


Figure 3. The Interacting Constructs of SROM (Drawn by the author).



Figure 4. System Research Organization Model for EBD in hospital design process (Figure 3 is Drawn by the Author)

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Person-Environment Relationship (Fit)

This study aims to suggest an efficient and valid process for guideline formation and while doing so, it is intended to obtain a personal environment fit with EBD design features so that hospital environments can be healing environments. The person-environment relationship (fit) proposed by Murrell and Norris (1983) defined quality of life as the criterion for establishing relationship between the person and his or her environment and, in one sense, represents a marriage between objective and subjective indicators of quality of life (Wang and Klassen, 2021). Figure 5 illustrates a person environment relationship with its influences.

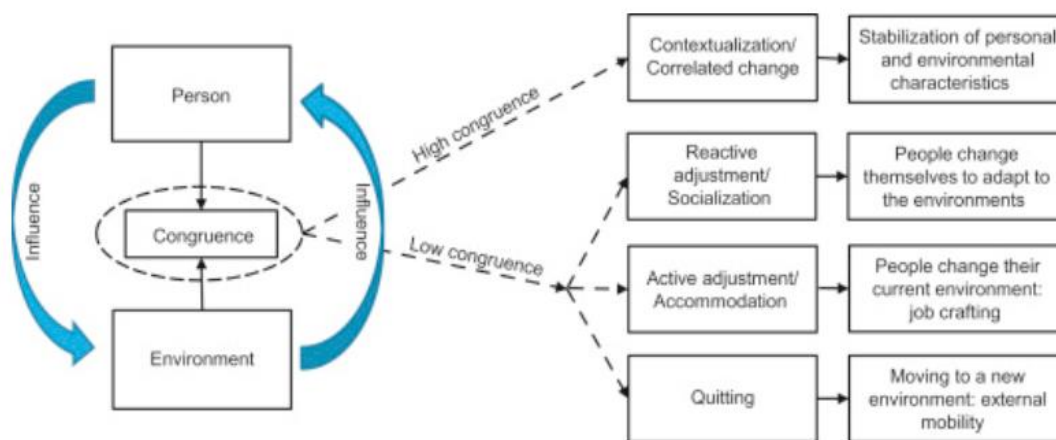


Figure 5. Person-environment relationship (Figure 5 is Taken from Holland, 1997)

4. DISCUSSIONS and RECOMMENDATIONS

In our recent life, healthcare facilities including hospital environments have not been designed efficiently with EBD approach. However, it is clear that with EBD approach hospital environments are more effective in terms of healing. For efficient healing environments with EBD approach hospital environments should be designed with some guidelines. This study is a preliminary study with initial suggestions and observations. Later on with more additions to the methodology this study might lead to an efficient and valid guideline formation and it can be used in the hospital design industry to have a better person-environment fit and healing environment accordingly.

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**DEVELOPMENT OF USER-ECOSYSTEM SENSITIVE PROPOSALS FOR
SUSTAINABLE LAND USE PLANNING IN BEYKOZ AND HIDIV PAVILION
GROVES**

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ABSTRACT

Beykoz and Hidiv Pavilion Groves, which are out of the historical groves on the Anatolian side of İstanbul, constitute the research areas of this study. Both of these groves are located within the border of the Beykoz District in İstanbul, and they overlook the Bosphorus. Since the forest ecosystems primarily dominate these groves, and accordingly these ecosystems are under the common threats of today's metropolitans such as urban sprawl, population, and social pressure, sustainable land use plans that equally take user and ecosystem sensitivities into account, should be proposed for them. Therefore, user surveys on these groves must target not only improving their recreation potential but also sustaining their ecosystem protection. Hence, this study intends to find out the proposals for the sake of possible alternative, yet sustainable land uses for recreation and conservation within these Beykoz and Hidiv Groves by referring to the visitor survey. The survey form questioned the visitors' comprehension, preferences, sensitivity, and suggestions on the groves based on their gender, age, education, livelihood, income, time spent in İstanbul, and distance to grove, groups. According to the survey with 113 persons, the "pavilion and restaurant" was primarily regarded as the focal point with the highest (44%) consent whereas the "green texture and nature" of the groves was their most attractive characteristic (with 53% acceptance). However, primarily "picnic, snack bar and tea garden" was highly proposed as an alternative recreation opportunity with 32% offering by those visitors. Nonetheless, "restaurants and cafeterias" were found the most adequate (with 41% satisfaction) by those visitors whereas they suggested "prayer, ablution and baby care rooms" and "book reading room" were suggested to be built with 19% and 17% advices respectively. On the other hand, the visitors (27% and 29%) insisted on "banning any further constructions except the walking pavements" and "banning all activities that will harm vegetation" respectively. They (28%) also stated to "ban any logging and mis-intervention to monumental trees" to prevent any further hazards within the groves. The survey overall proposed to introduce basic recreation opportunities and human necessities without increasing constructions and harming the environment for sustainable land use planning within the groves.

Keywords: Urban Grove, Recreation Planning, User Survey, Landscape Ecology, Sustainability.



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1. INTRODUCTION

Urban parks, which are generally evaluated within the context of urban forests (Forrest & Konijnendijk, 2005), invite the urban public and visitors to a relatively natural environment. These urban parks, sometimes in the form of forests and groves, frequently offer recreation for those people (Öztürk & Ağırtaş, 2020). Occasionally composing the trees and shrubs with the structural elements, urban forests, and groves serve the urban public and visitors by providing variable opportunities. Thus, principally they provide an aesthetic appearance (Gunnarsson et al., 2017), may lead guests to their interior destination, may supply shadow against direct sunlight (Zhang et al. 2013), also may isolate and confine separate guests. On the other hand, the groves particularly within the metropolitan cities, are very significant in terms of not only maintaining urban greenery percentage but also ensuring services of their ecosystems to the urban public. Groves that are large enough or sufficient in number to include different land use alternatives decorated with associated necessary buildings, will serve, entertain, and to some extent meet even the needs of a crowded urban population (Köse et al., 2023). However, the quantitative and qualitative sustainability of these groves must be secured for the physical and mental well-being of society (Mahmoud, 2011) as well as for conserving the urban natural environment. On the other side, urban groves, forests, and parks are under the threat of urban sprawl due to the increase in the population particularly within the metropolitan cities (Arshad et al., 2022). Therefore, shrinking and limited urban groves, forests, parks, and associated natural ecosystems will unavoidably be far from supplying recreation services that will meet the increasing demands of these populated modern societies within those metropolitan areas in particular (Mascarenhas et al., 2019). Among those urban groves, forests, and parks of metropolitan cities, İstanbul home to many urban groves, forests, and parks, some of which are historical and therefore host to many monumental trees (İMM, 2014).

Out of the historical groves on the Anatolian side of İstanbul, Beykoz and Hıdiv Pavilion Groves, which are host to monumental trees, constitute the research areas of this study. They are located within the border of the Beykoz District in İstanbul. Both of them involve spectacular landscapes and sceneries, which overlook directly the Bosphorus. These groves are dominated primarily by the forest ecosystems, which include diverse coniferous, evergreen, and deciduous tree and shrub species. Accordingly, urban sprawl, population increase, and social pressure also threaten these metropolitan ecosystems. Thus, sustainable land use plans should be proposed for them. However, these sustainable land use plans should equally take the user and ecosystem sensitivities into account. Otherwise, the user preferences regardless of conservative approaches and attitudes might lead these urban forest, grove, and park ecosystems to the risk of excessive construction in favor of meeting particularly the urgent, concrete, and physical needs of the visitors. Therefore, user surveys on these groves must target not only revealing, realizing, and improving the opportunities of their recreation potential and services but also sustaining their ecosystem protection.

Hence, by referring to a visitor survey, this study intends to find out and develop sustainable land use plans and proposals for these Beykoz and Hıdiv Pavilion groves. In this way, truly necessary recreation opportunities and alternatives can be suggested as well as securing the conservation of naturalness within these groves. Thereby, a survey form was prepared for the visitors not only aiming to question their awareness and satisfaction with the actual facilities and recreation services but also intending to discover their true necessities for the possible facilities and recreational opportunities. In addition, this survey form proposes to reveal and,

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even stimulate the sensitivities of those visitors on the naturalness and preservation of the groves. Moreover, by this survey, conservative approaches and attitudes of the visitors can directly be reflected in the plans, projects, designs, and applications on these groves, and they can be represented in the act of decisions, reclamation, and management proposals for the future land uses within these groves.

2. MATERIALS AND METHODS

Site Characteristics



Figure 1. Location of Hidiv Pavilion-grove and Beykoz grove within İstanbul and Turkey

The Hidiv Pavilion and grove, which cover approximately 21.28 ha, is located between the $29^{\circ} 04' 15''$ and $29^{\circ} 04' 49''$ eastern longitudes, and between the $41^{\circ} 06' 08''$ and $41^{\circ} 06' 27''$ northern latitudes. The Beykoz grove, which covers approximately 27.85 ha, is located between the $29^{\circ} 05' 50''$ and $29^{\circ} 06' 30''$ eastern longitudes, and between the $41^{\circ} 07' 52''$ and $41^{\circ} 08' 15''$ northern latitudes (Figure 1). The altitude of the Hidiv Pavilion and grove extends from the sea level up to only 80 m asl. The altitude of the Beykoz grove extends from the sea level up to 121 m asl. İstanbul's climate is a transition between Black Sea and Mediterranean climates (Atalay, 2011). The forest ecosystem is primarily composed of stone pines (*Pinus pinea* L.), sweet chestnuts, (*Castaena sativa* Mill.), oak species (*Quercus* sp.), European hornbeams (*Carpinus betulus* L.), oriental beeches (*Fagus orientalis* Lipsky), silver lindens (*Tilia tomentosa* Moench.), oriental planes (*Platanus orientalis* L.) and black locusts (*Robinia pseudoacacia* L.) as representing dominant coniferous and deciduous trees, with oriental hornbeams (*Carpinus orientalis* Mill.),

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strawberry trees (*Arbutus unedo* L.), Judas trees (*Cercis siliquastrum* L.), bay laurels (*Laurus nobilis* L.), and dog roses (*Rosa canina* L.) as representing dominant evergreen and deciduous shrubs (Yaltırık et al., 1997; Tarakçı et al., 2012). The limestones dominate the region's geological structure, where mainly brown forest soils have formed on (Atalay, 1982; Atalay, 2008).

Land Uses within the groves

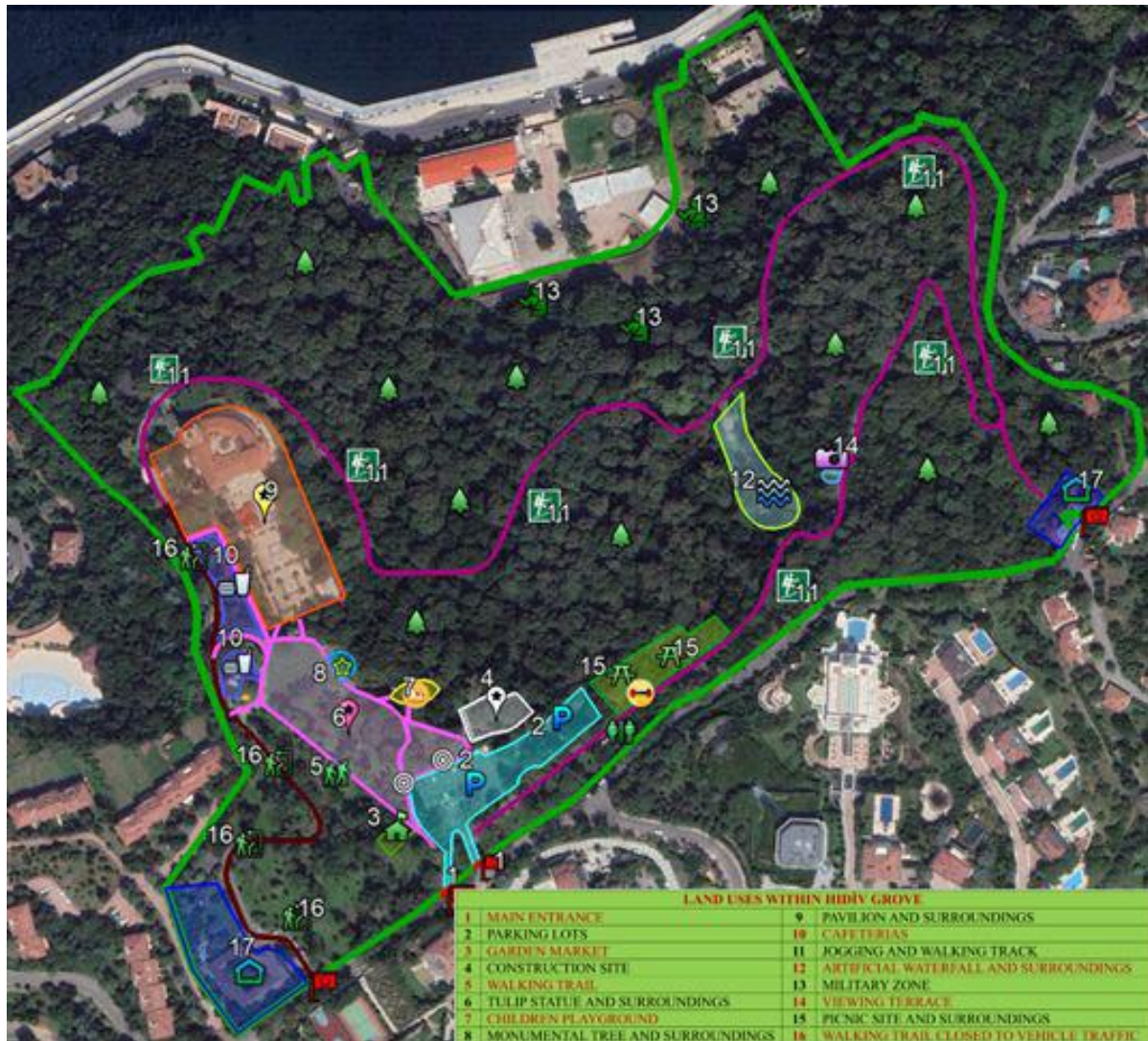


Figure 2. Location of 16 different land uses within Hıdiv Grove

Determination of the land uses within the groves, is significant in terms of indicating the existing land use situation within these groves. Hence, their distribution in number and size can be evaluated as being data during their already management. Thus, alternative land uses and suitable areas for those alternative land uses can also be determined. Thereby, these data can be referred to for suggesting alternative land use plans and proposals when necessary. Therefore, as is presented in Figure 2, Hıdiv grove homes to 16 different land uses. These land uses consist of “main entrance”, “parking lots”, “garden market”, “construction site”, “walking trail”, “tulip statue and surroundings”, “children's playground”, “monumental tree and surroundings”,

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“pavilion and surroundings”, “cafeterias”, “jogging and walking track”, “artificial waterfall and surroundings”, “military zone”, “viewing terrace”, “picnic site and surroundings” and “walking trail closed to vehicle traffic” (Figure 2). The land use map indicates that the constructed surfaces are relatively restricted within this Hıdiv Grove, where the pavilion stands, and represents the major building there (Figure 2).



Figure 3. Location of 32 different land uses within Beykoz Grove

On the other hand, Beykoz Grove is home to 32 different land uses which involve “coastal entrance”, “artificial waterfalls and surroundings I and II”, “walking trail”, “vehicle roads and walking pavements I and II”, “viewing terraces I and II”, “social center”, “pedestrian entrance”, “children playgrounds and surroundings I, II, III, IV, V, and VI”, “playground and recreational field”, “management and construction buildings”, “picnic sites and surroundings I, II, and III”, “entrance doors I, II, and III”, “countryside café”, “terraces”, “walking trails closed to vehicle traffic I, II, and III”, “pedestrian ways”, “parking lots”, “construction site”, “sports field” (Figure 3). The land use map indicates that the constructed surfaces are relatively more than the Hıdiv Pavilion Grove, yet they are relatively scattered within the Beykoz Grove (Figure 3).

Visitor Survey

A visitor survey was conducted with 113 persons initially questioning their gender, age, education, livelihood, and income. The survey form was attached to this study as presented in Table 1.

The survey form questioned the visitors’ comprehension, preferences, sensitivity, and suggestions on the groves regarding their gender, age, education, livelihood, income, time spent in İstanbul, and distance to grove, groups (Table 1). The form also referred to their awareness and satisfaction with the existing situation-equipment, actual facilities, and recreation opportunities (Table 1). Their approaches and attitudes towards sustainability, protection and,



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to anticipating and avoid the possible causes of danger-threats on the groves, were also inquired (Table 1).

Table 1. Survey form for the users of Beykoz and Hidiv pavilion groves

 BARIN UNIVERSITY GRADUATE SCHOOL DEPARTMENT OF LANDSCAPE ARCHITECTURE					 ISTANBUL METROPOLITAN UNIVERSITY DEPARTMENT OF PARKS, GARDENS AND GREEN AREAS DIRECTORATE OF URBAN ECOLOGICAL SYSTEMS	
Study Subject: Development of User-Ecosystem Sensitive Proposals for Sustainable Land Use Planning in Beykoz and Hidiv Pavilion Groves						
SURVEY FORM FOR THE USERS OF BEYKOZ AND HIDIV PAVILION GROVES						
GENDER:	SIR			LADY		
AGE:	18-25	26-35	36-45	46-55	56-65	66+
EDUCATION:	Non or Dropout	Primary	Secondary	High School	University	Graduate
LIVELIHOOD:	Retired	Civil Servant	Private Sector	Rent-Property	Municipality Worker	
INCOME:	Non-Below Subsistence Wage	Subsistence Wage	Subsistence Wage-4000TL	4000-6000TL	6000-8000TL	8000TL+
ISTANBUL: How many years have you been in?	Born-Bred	0-5 Years	6-10 Years	11-20 Years	21-30 Years	31+ Years
DISTANCE TO GROVE: Where do you come from to this grove?	From Close Neighbourhood	From Close District	From Far Di district of Beykoz	From Di fferent Sub-province in Anatolian Side	From European Side	Outside of Istanbul Outside of Turkey
FOCAL POINT: Where is the major focal point of the grove?	Pavilion and Restaurant	Pool and Surrounding	Waterfall and Surrounding	Walking Trail	Forest and Coppice	
MOST ATTRACTIVE CHARACTERISTIC: What is the most attractive characteristic of this grove?	Historical and Cultural Texture	Green Texture and Nature	Sea View	Social Environment and Friends	Walking and Sport Opportunity	Voices of Nature (Silent Field)
PRESENT RECREATION OPPORTUNITY: Which recreation opportunities are you aware for the grove?	Catering	Walking and Touring	Festival	Cycling and Active Sport	Art Activity	
ALTERNATIVE RECREATION OPPORTUNITY: Which recreation opportunity do you think should be introduced to the grove?	Picnic, Snack Bar and Tea Garden	Landscape Viewing and Photographing	Chess and Checkers	Event Promoting the Area and Trees	Social Facilities for Handicapped	Nature Recital and Sounds
SUFFICIENCY OF FACILITIES: Which facility do you think is most sufficient?	Restaurants and Cafeterias	Parking Lots and Car Parks	Sports and Playgrounds	Snack Bars and Markets	Recreational Areas and Surroundings	
ALTERNATIVE FACILITIES: Which facility do you think should be introduced to the grove?	Book Reading Room	Crafts Workshop and Course	Plant Introduction, Nursery and Greenhouse Course	Basketball, Football and Volleyball Field	Bicycle Track for Children, Young and Elderly	Prayer, Ablution and Baby Care Rooms
	Area Promoting Hall for Handicapped	Indoor Lounge for Seating in Rainy Weather	Countryside Wedding and Photographing Square	Gym for Handicapped	Tea and Coffee Room with Sea View	
PRESENT URBAN EQUIPMENT: Which urban equipment do you think is the most sufficient within the grove?	Lighting Equipment	Direction Boards	Sitting Benches	Groundcover Plants and Flowerpots	Protection, Blocking and Separation Fences	Table and Chair Covering Elements for Restaurant and Cafeteria
	Waste Baskets	Land Use and Reception Boards	Picnic Tables	Fountains, Shadirvans and Water Fountains	Wooden Bridges	
ALTERNATIVE URBAN EQUIPMENT: Which urban equipment do you think should be introduced to the grove?	Introducing Boards for Trees and Plants	Bicycle Park Equipment	Wrought Iron on Roadsides	Walking Paths and Ramps for Handicapped	Pergolas and Gazebos for Landscape View	Rope Climbing Equipment for Kids
	Night Lighting of Trees and Plants from Below	Changing Cabins for Sports and Activity	Separation Equipment for Vehicle and Walking Path	Audio Guidance Signs for Handicapped	A ccessories for Vertical Garden and Living Wall	
PROTECTION-USE BALANCE: What is the most necessary decision and precaution to ensure the protection-use balance within the groves?	Allowing limited number of vehicles into the groves and no more parking	Allowing a limited number of people into the groves and charging entry fees for more	Limiting access to trees, flowers and grass fields	Allowing only walking paths and no more structural facilities	Increasing security personnel, equipment and activities for protection and monitoring purposes	
SUSTAINABILITY: What is the most necessary decision and precaution to ensure the sustainability within the groves?	Renewal of roads in the groves using natural materials	Conversion of grass areas into the forest understorey in the groves	Meeting water needs of the groves through economic and ecological means	Not allowing activities that will cause destruction of vegetation in the groves	Not allowing activities that will cause destruction of wildlife in the groves	
DANGER AND THREATS: Which application do you think will be the most dangerous and threatening for the groves?	Unnecessarily cutting trees from the groves and improper intervention on monumental trees	Construction of additional buildings and construction of excessively hard ground such as vehicle roads	Allowing vehicle entry and free movement into the groves beyond its capacity	Security weakness, uncontrolled entrances, and free movement in green areas	Allowing fires in picnic and outdoor seating areas	Allowing activities that will cause destruction of existing vegetation and wildlife in the groves



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3.FINDINGS and DISCUSSION

According to the survey with 113 persons, about 75% of them were under 45 years old whereas 66% of them had at least high school degree. On the other hand, almost half of them had been working for a private sector with salary at least above the then subsistence wage. Besides, about 70% of them had been coming from either close or far locations of Beykoz Sub-province, İstanbul. In their study for small urban parks of Shangai, China, Wang et al. (2021), emphasized the significance of the factors of “age”, “income”, and “distance from park” on the use of those small urban parks.

The 44% of the users; being the highest consent, regarded primarily the “pavilion and restaurant” as the focal point within the groves. However, 53% of them drew attention on the “green texture and nature” of the groves for accepting it as their most attractive characteristic. In fact, 56% of the ladies found the “green texture and nature” as the most attractive characteristic within the groves. Indeed, in their study considering six different green spaces, Ode Sang et al. (2016) reported that the ladies had preferred the urban green spaces rather than the sirs and expressed their more well-being there compared to the sirs. The 54% of the visitors stated that they were aware of the “walking and touring” recreation opportunity within the grove. On the other side, higher percentage of those visitors (with 32% consent) primarily proposed “picnic, snack bar and tea garden” as alternative recreation opportunity within the groves. Hence, the visitors from the close locations of the İstanbul highly preferred “picnic, snack bar and tea garden”. In their survey study for the urban parks of a rapidly urbanizing city of Ethiopia, Azagew and Worku (2020) indicated that the distance to the urban parks, had significant association with the frequency of park visit.

Nonetheless, the visitors found the “restaurants and cafeterias” as the most adequate (with 41% satisfaction). However, they suggested to build “prayer, ablution and baby care rooms” and “book reading room” with the advice of 19% and 17% respectively. Besides, “lighting equipment” was found as the most sufficient (with 17% satisfaction) equipment by those visitors. Moreover, they suggested to introduce “signing boards for trees and plants” and “pergolas and gazebos for landscape view” with the advice of 19% and 17% respectively. Indeed, for the users of the small park in Oslo, Norway, Nordh et al. (2011) remarked the most influence of amount and density of the grass, trees, and other people, on their choices of park alternatives. On the other hand, respectively the 27% and 29% of the visitors insisted on “banning any further constructions except the walking paths and pavements” and “banning all activities that will harm vegetation” to ensure the sustainability within the groves. For instance, for an urban park close to our study groves, Öztürk and Ağırtaş (2021) indicated that the construction interventions had led to the increased openness within the canopies of the tree and shrubs. However, 28% of the visitors also stated to “ban any logging and mis-intervention to monumental trees” in order to prevent any further hazards within the groves.

According to the overall results of this study, although half of the users declared that they had focused on the fundamental monumental buildings and, had insisted on the necessity of other structural facilities, they also admitted that they had been impressed by the greenery and nature of the groves. On the other hand, some users couldn't completely give up on the introduction of the structural facilities, demanding new structures for only other recreational and human services rather than catering. However, most of the users conceded that further intervention and



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construction would have more or less degraded that naturalness, and therefore had suggested these interferences should have been prevented.

4. CONCLUSION and RECOMMENDATIONS

In order to secure sustainable land use planning together with the conservative applications and management within the groves, the survey results overall suggested and proposed to introduce basic recreation opportunities and human necessities without increasing constructions and buildings, and without harming the environment. Therefore, only truly necessary facilities and recreation opportunities should be included into the groves. Otherwise, unnecessary further facility applications, constructions, and buildings may lead to the capacity strain for the land uses, which then may threaten the ecosystem structure and naturalness of the groves. Thus, treating the urban forests, groves, and parks, demands sustainable approaches by implementing ecosystem conservation and restoration practices during the application of any recreational projects and facilities within them (Steiner, 1999).

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FROM SHOWCASE TO FACADE: ADAPTATION OF SHOWCASE CONCEPTS TO STORE FACADE DESIGN

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ABSTRACT

Showcases are display spaces that convey information about the stores. In addition to product display, arrangements are made in the showcases that display the store and the store's top identity with creative concepts. In today's showcase design applications, it is seen that it extends to the facade. At this stage, the interior of the showcase and the store architectural facade turn into a platform in design applications as a whole. Thus, customers' interest in the store and their general impressions about the store can be positively affected. Artistic and creative original concepts support this stage. In the study, it is seen that store façade designs have a wider impact on customer perception and experience in the retail sector with the integration of the showcase concept. In this parallel, it is analysed how the application of storefront concepts to the façade design can change customer perceptions and attitudes towards the store. Afterwards, it is discussed how to construct the shop window design at the architectural façade boundary. Combining store fronts with showcase concepts can better reflect the brand identity and thus increase the brand loyalty of customers. This study clarifies how to establish and implement an integrity with the facade while designing showcases with interior architecture discipline. With the support of literature and sample applications, the adaptation of the design concept from the showcase to the facade is reinforced.

Keywords: Showcase, Facade, Concept, Design.

1. INTRODUCTION

The retail sector is in a continuous transformation process due to rapidly changing consumer preferences and the intensity of competition. Store owners and managers have to constantly review their strategies to attract customers and increase sales. In addition to the interior design of the store, its location, and layout, the image created in the external environment undertakes a symbolic representation task. In this task, it can provide functional and social advantages to customers. The importance of the outer shell of the store emerges in inviting customers into the space by being noticed in the external environment and conveying a visual message in a fun and effective visual silhouette (Verma, 2018). In this context, the facade design of stores plays a major role in the first interaction moment. Store fronts offer important clues to potential customers about the content and spirit of the store and therefore its design can affect the success of a store.

Apart from the act of shopping, stores have features that define the brand in the external environment, display products, express brand innovations and values, and increase customer loyalty (Foncillas, 2020). Showcases can be designed not only as a display of products, but also as a work of art. This artistic approach can help the store to offer an aesthetic experience and help customers to establish an emotional connection. Nowadays, shop windows have become



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the outward facing face of stores and have become a part of not only the products, but also the brand identity and even the narrative of a story.

As a result, it aims to be a source of inspiration for professionals in the retail sector by emphasising how showcase concepts can be applied periodically in a holistic design language with the façade and the commercial advantages of the artistic approach. In the following sections, examples of periodical showcase applications and the reflection of the artistic approach from the micro-scale showcase to the macroscale facade are discussed.

2. MATERIALS and METHODS

In this study, the conceptual equivalents of showcases and mobiles are discussed and the micro-macro design approach is discussed with literature supports and inferences. This qualitative study describes the subject graphically with the support of the literature. Thus, it tests the issues within the subject, limitations and discussion for future studies.

3. Store Facade Design and Showcase Concepts

Showcases basically aim to protect and show. Showcases are basically the unit of the space that protects the products from the environment while exhibiting them. The goal of displaying in this unit is to show the product, to identify the store to which the product belongs and to convey the value of the brand belonging to the store with a summary information (Mesher, 2013). The origins of showcases date back to the late 18th century. The production technologies developed with the industrial revolution have brought opportunities to all areas of life. The fact that glass material can be produced in large surfaces has brought vitrines to a defined state. During this period, as the retail sector grew, store owners developed the need to better display their products. In the process until today, showcases fulfill various functions in the retail sector;

Product Display,

Representing Brand Identity,

Showing Season-Collection Stories of Products,

Customer Attraction and Attracting Attention.

The outer shell of the architectural volume is the structural unit that limits the inner shell and creates comfort with environmental parameters. The facade also has an identity expressive function that defines who the building belongs to. This expression is blended with visual aesthetic concerns and functional infrastructure, adding value to the architecture (Jin & Overend, 2014).

Facade design offers customers an invitation to enter the store. A well-designed facade encourages customers to step into the store and starts their time inside in a more positive way. Furthermore, the facade design can reflect the store's brand identity and values. The brand's colours, logo and overall design aesthetic can be used in the facade design and this can help to create a bond between the brand and customers.

In short, from past to present, shop window and facade design is a critical element that greatly influences the customer experience. By having an inviting image, it attracts customers to the store and allows them to have a more positive experience inside. Functionally, it can benefit the structure and the individual's use of building-space.

4. FINDINGS and DISCUSSION

The eye is one of our five sense organs that provide visual perception. It can be said that it is one of the first and most important perceptions in our life experiences. In this respect, stores are important in the perception of the outer shell as an architectural volume. When we consider the viewing angle of the human eye from the literature; It is stated that it has an average of 135 degrees vertically and 180-200 degrees horizontally (Luz, 2021). Seeing an object varies according to distance. As in Figure 1, the visual angle of the object getting closer to our eyes increases. As the same object moves away from our eyes, the visual angle decreases. Visual perception can change according to the distances of objects (Visual Angle, 2022). In this respect, while the object is perceived with large viewing angles at close distances, larger objects can be easily perceived with small angles at distant distances.

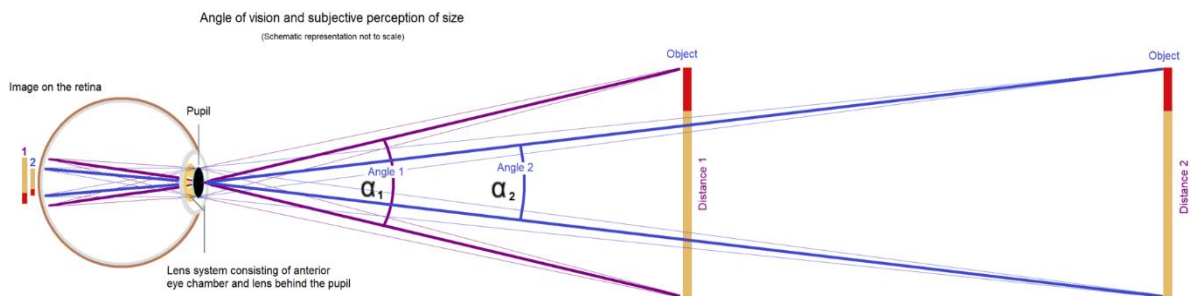


Figure 1. Visual Distance of the Eye (URL1).

In this parallel, shop windows can offer a limited visibility with a wide angle at close range. Due to its large volume, the architectural facade can offer a more optional visual perception with small angles from long distances. It is emphasised that retailing approaches in competitive conditions have started to create atmospheres that emphasise the brand and differentiate it from the environment (Turley & Chebat, 2002). The recognition of the stores and the product-based trends and narrative concepts that change according to the seasons can be conveyed through common narratives reflected on the facade from the shop windows. This transfer is shown in Figure 2. In order to increase the attractiveness of the stores from long distances and to show the products and the stories of the products exhibited in the showcases from long distances, integrated design applications have recently been made on the facades.

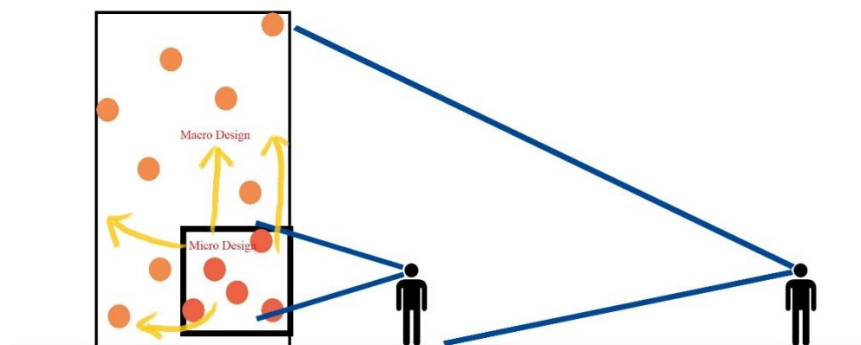


Figure 2. Showcase Facade Vision Perception (by the author)



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The architectural facade, which is large in size in line with the visual characteristics of our eye organ, can also be integrated with the design concept applied as a period of showcases. Showcases show the store and the products sold in an external environment such as a street, street or in an internal environment such as a shopping centre. The showcase displays the products in a limited space by protecting them with a glass surface. This boundary can be originated with the creativity of art, which is unique in the culture of consumption. The concepts applied in showcase designs are at the targets that attract attention in this flow and make the brand feel at high levels (Crewe, 2016). In current applications, these objectives are not limited to showcases but also extend to the facade. Depending on the characteristics of the architectural structure, the showcase concept can provide many advantages by reflecting to the outside and going to macro scales.

On the basis of the product, it is exhibited according to the viewing distance of individuals and the volume of the space. Closer monitoring is taking place here. The external environment can be perceived from long distances. At this stage, the facades that define the store come to the fore. Showcases are approached with the image given by the facade. The first impression can be realised with the image given by the facade from a long distance. The shop window is approached in a chain and the store can be entered. Here, a guiding effect can be realised with a holistic expression of the concept of showcases at a closer distance than the distant architectural facade.

In addition, designs that can be installed and dismantled on the facades, just like the shop windows, should be realised within the specified period. Based on the surface and structural limitations of the architectural facade, facade designs that can be installed and dismantled should be planned. The design language in the shop windows should be at the same equivalence on the facades. Because the facade seen from a long distance should be a deceptive display with the showcases to be watched closely. With the application of a whole design language on the facades and showcases, the products sold by the store can be shown correctly. Entering and shopping in the store to be formed together can benefit the consumption experience. Thus, the loyalty of the brand to individuals can increase. The shopping action that can be repeated for future times can be created with this flow.

5. CONCLUSION and RECOMMENDATIONS

The display concepts adapted according to the sales seasons in shop windows are also reflected in the facade design in terms of attractiveness. The facade can be designed in parallel with the display concept applied in the shop windows. As a result, the facades, which are the first to be monitored, can focus on the showcases by making a call to distant distances. An aesthetic presentation can be realised by watching the products in the showcases and the ongoing exhibition concept. Artistic applications transferred to facades and showcases can create memorable impressions. Recognition of brands, contribution to commercial action and satisfaction in consumption can be realised through common exhibitions on the facades extending from the micro scale of shop windows to the macro scale. This balance is established with the design discipline and can be revitalised with interdisciplinary multi flow in interior architecture-architectural areas.

In the study, concept integrity is considered in the common denominator and it aims to transfer a common design language from the shop window to the facade. Since the design is based on discipline planning, it is possible to be applied between micro-macro dimensions. For future



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studies beyond these limits, it is foreseen to investigate digital integration, customer experience and sales performance measurement, modular system proposals, material and application proposals in showcase and facade partnership.

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THE CONCEPT OF VALUES IN PROTECTED AREAS: A CROSS-CULTURAL RESEARCH

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ABSTRACT

People are inseparably linked with nature and the actions and behaviors of humans directly and indirectly affect the quantity and quality of nature. Its quality and availability likewise affect humans. Inevitably, some environmental problems have been an important issue in the past several decades, especially for protected areas. Such problems have been considered scientific and economic problems, yet there has been another approach merged in addition to scientific and economic ones as societal dimensions. Societal dimensions refer to how and why society value natural resources, how people want resources managed, and how people affect or are affected by protected area management decisions. The societal dimensions inquiries strive to understand human traits and how to incorporate that understanding into management planning and actions. The concepts of values toward protected areas have been analyzed in depth in developed countries (e.g., the US), but this argument, unfortunately, has not been discussed enough in developing countries (e.g., Turkey). Therefore, investigation of the value concepts by literature review in sociology and social psychology would allow us to overcome the initial steps of fulfilling the gap of the study on cross cultural understanding. The aim of this study is to provide an understanding of the values toward of protected areas as well as guidance on how these values can be understood and integrated into planning and design processes. Besides, to investigate how cultural differences influence people's value priorities in understanding and predicting of attitudinal and behavioral decisions to protected areas.

Keywords: Values, Protected Areas, Societal Dimensions, Culture.

1. INTRODUCTION

Environmental problems have been an important issue in the past several decades. Global warming and climate change due to the greenhouse effect, deforestation and species extinction, exhaustion of fisheries, agricultural land, and pollution of air and water supplies are some of the main dangers to the Earth (Oskamp, 2000). Earlier, environmental problems have been



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considered as scientific and economic problems, yet there has been another approach merged in addition to scientific and economic ones as societal dimensions. This approach has been drawing more public attention since the second half of the twentieth century.

The investigation of value concepts is one of the areas of social sciences. In this respect, the concepts of values toward protected environments have been analyzed in depth in developed countries (e.g. the US), but this argument, unfortunately, is not applicable to undeveloped and developing countries (e.g. Turkey). Therefore, investigation of the value concepts by literature review in sociology and social psychology would allow us to overcome the initial steps of fulfilling the gap of the study on cross cultural understanding.

In this paper, the focus is to investigate how cultural differences influence people's value priorities in understanding and predicting of attitudinal and behavioral decisions. The following literature are used to attempt to demonstrate and support this argument stated above.

2. MATERIAL and METHOD

Definitions of "Value"

The term value is quite complex, as it is a multi-dimensional concept that is often viewed synonymously with many other similar terms such as beliefs, attitudes, preferences, desires, likes, meanings, and benefits. The concept of values has been applied to various social sciences; however, there is no consensus on the definition of values. Deth & Scarbrough (1995) came up with more than 180 different definitions of values.

In the study of Rohan (2000), the word of "value" is used either as a verb or noun. As a verb, value refers some higher-level evaluation. When people use value as a verb, they are expressing a deeper meaning related to its entity. On the other hand, value, as a noun, was investigated as a dilemma in that people use value to evaluate their environment to understand their motivations under their responses to environments. Schwartz & Bilsky (1987, 1990), proposed five features of the values: (1) beliefs, (2) desirable end states or behaviors, (3) trans-situational guides, (4) selection and evaluation of behavior and events, and (5) the relative ordering of beliefs, desirable and states or behavior or guides.

Although the values are divided as value priorities and evaluations of specific entities, people use different expressions. Rohan (2000) states that people use the word of value for their evaluations of specific entities, and they also use to describe their evaluations of abstract trans-situational guides. However, the term of value is not appropriate for the trans-situational evaluation. For example, people may say "I value that table", and say "I value security." In detail, perhaps, people may assume, in this case, table is equally important to security by the usage of "value", which may generate ambiguity. Rohan (2000) brought the term "attitude" to distinguish these two different concepts of value, which is a genuine solution for this ambiguity. Overall, as a verb, value means the process of ascertaining the merit of an entity, whereas a noun version refers to the result of this process.

Henning (1998) defines values as "individual and collective concepts with emotional, judgmental, and symbolic components that we use to determine what is important, worthwhile and desirable. Thus, values contain, and at the same time evolve from, judgements and beliefs about what is 'good' or 'bad' and 'right' or 'wrong'."



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Vaske and his colleagues (2001) describe two types of beliefs, one is basic beliefs which “strengthen and give meaning to fundamental values” and the other is normative beliefs which are “judgements about what is appropriate in a specific situation.”

3. FINDINGS

Approaches to the Values Concept

Although multiple definitions have been offered in literature, there are three popular social psychologists offering research theories about values: Milton Rokeach, Shalom Schwartz, and Ronald Inglehart.

Rokeach (1973) defined values as the guiding principles in the life of an individual or a group. “Value is an enduring belief that a specific mode of conduct or end state of existence is personally or socially preferable to an opposite or converse mode of conduct or end state of existence” (Rokeach 1973, pg. 5). He proposed two sets of values: the terminal values and instrumental values. The terminal values refer to desirable end-states of existence, while the instrumental values refer to preferable modes of behavior. Eighteen value types are listed for each set. Terminal values are a world at peace, family security, freedom, equality, self-esteem, happiness, wisdom, national security, salvation, true friendship, a sense of accomplishment, inner harmony, mature love, a comfortable life, a world of beauty, pleasure, social recognition, and an exciting life. Instrumental values are ambitious, broadminded, capable, cheerful, clean, courageous, forgiving, helpful, honest, imaginative, independent, intellectual, logical, loving, obedient, polite, responsible and self-controlled.

Schwartz (1992) defined value as: “a desirable trans-situational goal varying in importance, which serves as a guiding principle in the life of a person or other social entity” (pg. 21). Accordingly, Schwartz (2006a) proposed ten different basic values stated below (pg. 1-2):

1. Self-Direction: Independent thought and action; choosing, creating, exploring.
2. Stimulation: Excitement, novelty, and challenge in life.
3. Hedonism: Pleasure and sensuous gratification for oneself.
4. Achievement: Personal success through demonstrating competence according to social standards.
5. Power: Social status and prestige, control or dominance over people and resources.
6. Security: Safety, harmony, and stability of society, of relationships, and self.
7. Conformity: Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms.
8. Tradition: Respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provides the self.
9. Benevolence: Preserving and enhancing the welfare of those with whom one is in frequent personal contact (the ‘in-group’).

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10. Universalism: Understanding, appreciation, tolerance, and protection for the welfare of all people and for nature.

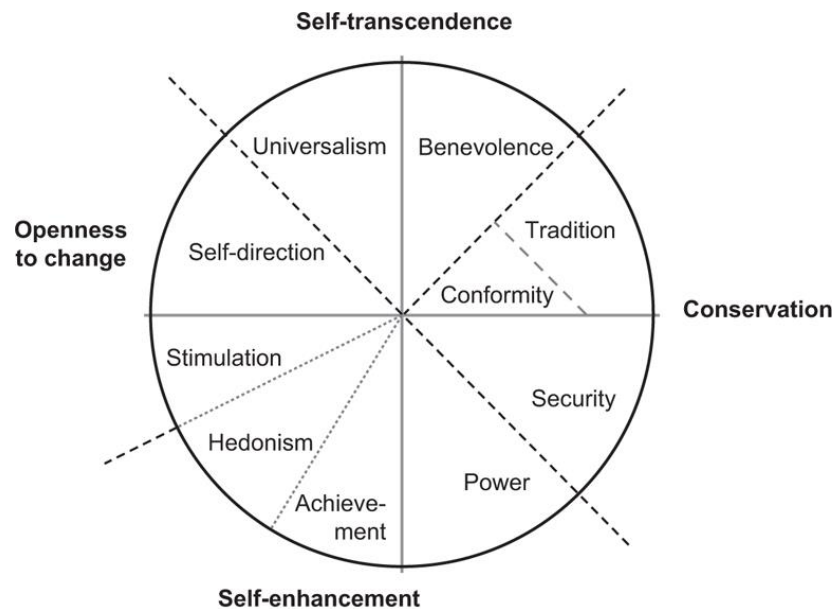


Figure 1. A theoretical model of the relation among values (Schwartz, 2005).

Schwartz distinguishes these ten value types by investigating individual levels of value, which are organized with two dimensions: (a) from self-transcendence to self-enhancement and (b) from openness to conservation. Self-transcendence is embracing the welfare of others. Self-enhancement is emphasizing individual's interests. Openness refers to accepting change, risk and unpredictability. Conservation means preservation of the status quo.

On the other hand, Schwartz (2006) approaches to the cross-cultural values different than the individual ones by distinguishing six primary values, which are: autonomy, embeddedness, hierarchy, egalitarian commitment, self-mastery, and harmony. People are viewed as autonomous, bounded entities in autonomy cultures. They should cultivate and express their preferences, feelings, ideas, and abilities, and find meaning in their uniqueness. People are viewed as entities embedded in the collectivity in cultures with embeddedness. The life bases on largely through social relationships, through identifying with the group, participating in its shared way of life, and striving toward its shared goals. People recognize others as moral equals who share basic interests as human beings in egalitarianism. People are socialized to internalize a commitment to cooperate and to feel concern for everyone's welfare. There is an unequal distribution of power and roles that relies on hierarchical systems in hierarchic cultures. Harmony emphasizes fitting into the world as it is, trying to understand and appreciate rather than to change, direct, or to exploit. Important values in harmony cultures include world at peace, unity with nature, and protecting the environment. Finally, mastery encourages active self-assertion to master, direct, and change the natural and social environment to attain group or personal goals. Values such as ambition, success, daring, and competence are especially important in mastery cultures Schwartz (2006 pg.141). A country's position on each of the six dimensions represents the nature of individuals' shared ideals within a specific cultural context. Since cultural values are defined as representing common ideals, they are derived by averaging



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the value priorities of individuals within a given society based on a multidimensional scaling analysis (Schwartz, 1994).

Inglehart (1977) came up with a post-materialist approach, individuals under the influence of material prosperity in modern industrial societies, tend to reject material values and to endorse new goals relating to quality of life. Although material values stem from needs for physiological sustenance and safety, post-material values stem from non-physiological needs, such as esteem, self-expression, and aesthetic satisfaction (Inglehart, 1990, p. 68). The post-materialist values are associated with a reshaping of social norms that emphasize new issues such as freedom, self-expression, and the quality of life. Inglehart (1977) developed an instrument for measuring value orientations. The instrument is consisted of a list of statements, which concern the evaluation of materialist and post-materialist political goals. He describes the tradition/secular-rational dimension, for example, as centrally concerned with orientations toward authority (Inglehart & Baker, 2000).

By considering the theories of value concepts proposed by Milton Rokeach, Shalom Schwartz, and Ronald Inglehart, culture is often defined as the integrated pattern of meanings, beliefs, norms, symbols, and values that individuals hold within a society, with values representing perhaps the most central cultural feature (Hofstede, 2001; Schwartz, 2004). These values “express shared conceptions of what is good and desirable in the culture, the cultural ideals” (Schwartz, 2004, p. 2). Parallel to individual-level values—which involve enduring goals that serve as guiding principles in people’s lives (Rokeach, 1973; Schwartz, 1992)—cultural value dimensions represent the society’s guiding principles. These principles contribute to the formulation of individuals’ attitudes, beliefs, and behaviors.

Rokeach (1977) notes that in human discourse it can be evidenced that “value” implies either,

- 1) a person holds a “value”, or 2) an object has “value” to a person.

On the one hand, **subjective “values”**, are conceived as standards, which are reflective of value formation and the determinants of valuing (in the verb sense). Williams and Watson (2000) define these values as something we value (ideals). They are influenced by the social, cultural, economic, educational, and many other broad national trends that one is exposed to in their lifetime. They encompass beliefs, perceptions, preferences, and value orientations and give rise to one’s environmental disposition, attitudes, and ethics. They also can be conceived as the precursors to natural resource legislation and policy, which leads to nature protection.

On the other hand, there are **objective “values”**, conceived in the noun sense as components of nature protection, which include such notions as inherent worth, intrinsic value, and instrumental, functional, and derived values. These values encompass human and ecological meanings and services and give rise to behavior. Williams and Watson (2000) define these values as something that is of value (benefit); they are viewed as some value to be gained or received from the environment rather than impressed upon it, and they precede valuation.

Rokeach’s methodology has since then been popularly used in natural resource research to measure values quantitatively. Researchers often employ Rokeach’s method by using a finite, quantitative rating system of environmental values in which respondents are encouraged to make explicit their hierarchy of values. (Brown & Reed 2000, Cordell & Stokes 2000, Cordell et al. 1998, and Haas et al. 1986). In these cases, the researchers pre-determined a list of environmental values in which, rather than ranking about the importance of the values in their



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life, respondents were asked to rate the values about their importance to wilderness, national parks, national forests, protected areas, etc. Survey responses were then offered to guide management actions and policy decisions.

One qualitative method that would be effective in measuring protected area values is the "Hermeneutic Approach." The hermeneutic paradigm focuses on the meaning of the experience, with the belief that "experience is best understood as a whole rather than as the sum of its parts". Following this method, open-ended interviews are employed, to receive narrative descriptions of protected area visitors. Open-ended interviews where the interviewer facilitated discussion about certain themes, without leading respondents to reveal meanings. The interviewer also asked for clarifications in responses as needed. They found that when responses were like telling a story, they were more successful in revealing meanings than if they were viewed as responses to interview questions.

Therefore, they encouraged "people to tell the story of the experience rather than list the aspects of the experience". From this, they sought to "identify predominant themes through which narrative accounts of specific experiential situations (could) be meaningfully organized, interpreted and presented". Not only were the researchers able to identify the quantitative, objective elements of experience that are important to visitors, but they were also able to realize the meaning behind the importance of those elements, therefore moving beyond a finite, quantitative rating system of environmental values.

Medina and Rodriguez (1998) used a "Participatory Rural Appraisal" methodology to assess perceptions of tourism impacts in Venezuela's Canaima National Park. This method was effective in identifying the social, cultural, and subsistence values that are attributed to environmental elements there. It was also useful for realizing present environmental changes that are influencing these values, as well as the source to which the change could be attributed.

Participatory Rural Appraisal is a method in which the learning of environmental values is "from, with, and by" a specific group of citizens under study. This method enables people "to share, enhance, and analyze their knowledge of life and conditions, to plan, to act, monitor and evaluate." Therefore, "information in Participatory Rural Appraisal is internally produced, analyzed, owned and shared by local people instead of just gathered and analyzed with the biases of outsiders" (Medina and Rodriguez 1998). This method, like the hermeneutic approach, seems appropriate for measuring values qualitatively. By focusing on the knowledge and experience of respondents themselves, researchers would be able to gain depth of understanding and, subsequently, identify a range of values truly held by respondents within a specific context.

4. CONCLUSION

According to literature that is covered above, we can summarize the main features of the conception of basic values:

- Values are beliefs, but they are beliefs tied inextricably to emotion, not objective, cold ideas.
- Values are motivational constructs that refer to the desirable goals people strive to attain.
- Values transcend specific actions and situations. They are abstract goals. The abstract nature of values distinguishes them from concepts like norms and attitudes, which usually refer to specific actions, objects, or situations.



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- Values guide the selection or evaluation of actions, policies, people, and events. That is, values serve as standards or criteria.
- Values are ordered by importance relative to one another. People's values form an ordered system of value priorities that characterize them as individuals. This hierarchical feature of values also distinguishes them from norms and attitudes (Schwartz, 2006a, pg. cover page).

In summary, the cultural approach to the concept of values focuses on phenomena arising from interrelations between an active individual and his/her culture. Values belong to the class of hierarchically organized symbolic tools that are used to regulate the social and psychological functioning of individuals and groups. The cross-cultural approach is useful for researching the development and functioning of a value system in concrete transactions between individuals and their environment. Values reflect both an individual's needs and social regulation. A value system provides a shared representational framework, in which different individual and group positions are possible.

It is important to understand values so that natural resource legislation and policy, nature protection, management and valuation decisions can be properly guided. A crucial component of this is reviewing the literature on the study of values so that familiarity can be gained with the broad array of terminology surrounding "values." It is also important to be familiar with the many different methods that can and have been employed in studying and measuring values. By refining and expanding upon past studies, as well as forging new ones, we can further expand our knowledge of the science of values.

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**ASSESSMENT OF THE EFFECTS OF URBANIZATION ON GREEN SPACES AND
LAND SURFACE TEMPERATURE: A CASE STUDY OF ESENYURT, İSTANBUL**

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ABSTRACT

With the rapidly increasing population in today's world, urbanization rates are also on the rise, subjecting our cities to more intense construction with each passing day. This situation adversely impacts cities in various ways, leading to the reduction of natural spaces, the degradation of green areas, and a decline in biological diversity. Additionally, dense urbanization, accompanied by the expansion of industrial areas and factors such as greenhouse gases, has precipitated a global increase in temperatures. In this study, Esenyurt, one of the districts of the Istanbul metropolis that has received significant immigration and experienced intense urbanization in recent years, has been the focal point. The research aimed to highlight the effects of the 28-year transformation in the Esenyurt district from 1990-2018 on Land Surface Temperature (LST) and vegetation. This was achieved by investigating the LST and Normalized Difference Vegetation Index (NDVI) values and their interrelations. These investigations were conducted by analyzing Landsat 5 TM and Landsat 8 OLI_TIRS satellite images from 1990 and 2018 using Geographical Information Systems (GIS) and Remote Sensing (RS) techniques. In this study, LST maps were generated utilizing satellite images from the relevant years. The relationships between these LST values and the NDVI values of the corresponding years were examined through correlation analysis. In conclusion, the impacts of Land Use/Land Cover (LULC) on the urban heat island, in conjunction with NDVI and LST, were evaluated using the Esenyurt district as a case study. Within this framework, measures that can be adopted to mitigate the urban heat island effect during urban growth have been presented.

Keywords: Urbanization, LST, NDVI, Esenyurt, İstanbul.

1. INTRODUCTION

Today's rapid urbanization has brought about many undesirable problems in cities, such as a decrease in biodiversity, poor air and water quality, floods, drought, high energy consumption and urban heat island effect (Feyisa et al., 2014; Topal, 2022). It is reported that the main reason



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for these emerging environmental problems and global climate change is due to increasing human activities (Demirbaş & Aydin, 2020). On the other hand, as the urbanization process increases in density and area on a global scale, land use and land cover changes also increase (Imhoff et al., 2010). Improper and uncontrolled implementation of these changes in urban areas has increased the effect of the urban heat island. The urban heat island effect is the accumulation of heat within an urban area. This situation occurs with the construction of urban areas (Yang et al., 2006; Qin, 2015). An urban heat island can be defined as a situation where urban areas have higher temperatures than surrounding rural areas (Deilami et al., 2018). When surfaces covered with vegetation and wetlands transform into areas dominated by impermeable surfaces, agricultural lands, or bare lands, it increases surface temperature and intensifies the urban heat island effect (Ahmed et al., 2013; Pal & Ziaul, 2017).

Land Surface Temperature (LST) value is used to measure temperature variations in cities and to understand changes in land cover (Imhoff et al., 2010). Today, Geographic Information Systems (GIS) and Remote Sensing technology (RS) are among the tools used for monitoring land use/land cover (LULC) changes and extracting the land surface temperature (LST) (Tomlinson et al., 2011; Kafy et al., 2020). Through RS studies, high-resolution LST maps of the desired area can be generated, allowing for quick detection of temporal changes (Mercan, 2020). On the other hand, NDVI (Normalized Difference Vegetation Index) is frequently used in vegetation transformations, land cover classification, and change analysis (Xu et al., 2016). The relationships between LST and NDVI have been explored in numerous studies (Gallo et al., 1993; Tan et al., 2020).

The formation of the urban heat island effect influences energy flow in urban ecological systems, hydrology, soil, climate, local environment, thermal comfort, and the health of the people in the region. However, it reduces air quality and increases ozone production (Stone & Rodgers, 2001; Yang et al., 2006; Zhou et al., 2011; Debbage & Shepherd, 2015). In this context, understanding heat island effects is very important in terms of improving the quality of life. Understanding how the model and structure of urban expansion influence the effects of urban heat islands is a significant topic for planning disciplines in terms of urban environmental planning and natural resource management (Imhoff et al., 2010; Tonyaloğlu, 2019). Since the intensity and scope of urbanization in developing countries are very high, researching the effects of urban heat islands in cities in these countries is becoming increasingly important (Pal & Ziaul, 2017). In this context, this study focuses on the Esenyurt district, which is the most populous district in our country, one of the developing countries.

In this study, the aim was to reveal how the 28-year change between 1990-2018 in the Esenyurt district affected the region in terms of land use, LST (Land Surface Temperature), and vegetation. In this context, the land use situation was determined, and the relationships between the Land Surface Temperature (LST) and the Normalized Difference Vegetation Index (NDVI) were investigated. These inquiries were conducted by analyzing the Landsat 5 TM and Landsat 8 OLI_TIRS satellite images for the years 1990 and 2018 respectively, using Geographic Information Systems (GIS) and Remote Sensing (RS) techniques. In the study, LST maps were produced using thermal bands of images from the relevant years. The relationships between LST and NDVI values for the relevant years were questioned by correlation analysis. As a result, the effects of LULC change and NDVI value on LST and the urban heat island were evaluated. In this context, measures that can be taken to reduce the urban heat island effect during urban growth have been presented.



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2. MATERIALS and METHODS

2.1. Materials

The main focus of the study is the Esenyurt district of Istanbul. Esenyurt is located on the European side of Istanbul. Esenyurt district is surrounded by Avcılar in the east, Büyükçekmece in the west, Başakşehir in the north and Beylikdüzü in the south (Figure 1). The district covers an area of 43.16 km². The D100 highway, which extends in a northwest-southwest direction, plays a significant role in determining the district's transportation and administrative boundaries. Additionally, in the west, there's the TEM-Hadımköy connecting road, and in the northern section, the O-3 Highway that connects the region to Thrace and Anatolia also contributes significantly. In the district, the slope generally varies between 5-20%, however, towards the east of the Hoşdere Esenyurt road and the Akçaburgaz, Atatürk, and İstiklal neighborhoods, the slope ranges between 20-31% and the land in these areas is elevated (Esenyurt Municipality, 2019).

Esenyurt district has a western Marmara continental climate in terms of weather conditions. Considering the general climate characteristics of Istanbul, summers are dry and winters are rainy. According to the long-term data (1950-2022) of the Meteorological General Directorate, the average annual temperature is 15.2°C. The average annual precipitation is 660.9 mm. The dominant wind direction is north and northwest. The 3rd degree strong wind is the south, southwest wind (Esenyurt Municipality, 2015; Turkish State Meteorological Service, 2023).

As of 2022, the population of Istanbul was 15,907,951. In the same year, the population of the Esenyurt district was 983,571. This population constitutes 6,18% of the province's population. With this population data, Esenyurt district is the most populous district in Türkiye. The population of the district is higher than in many provinces (TÜİK, 2023).

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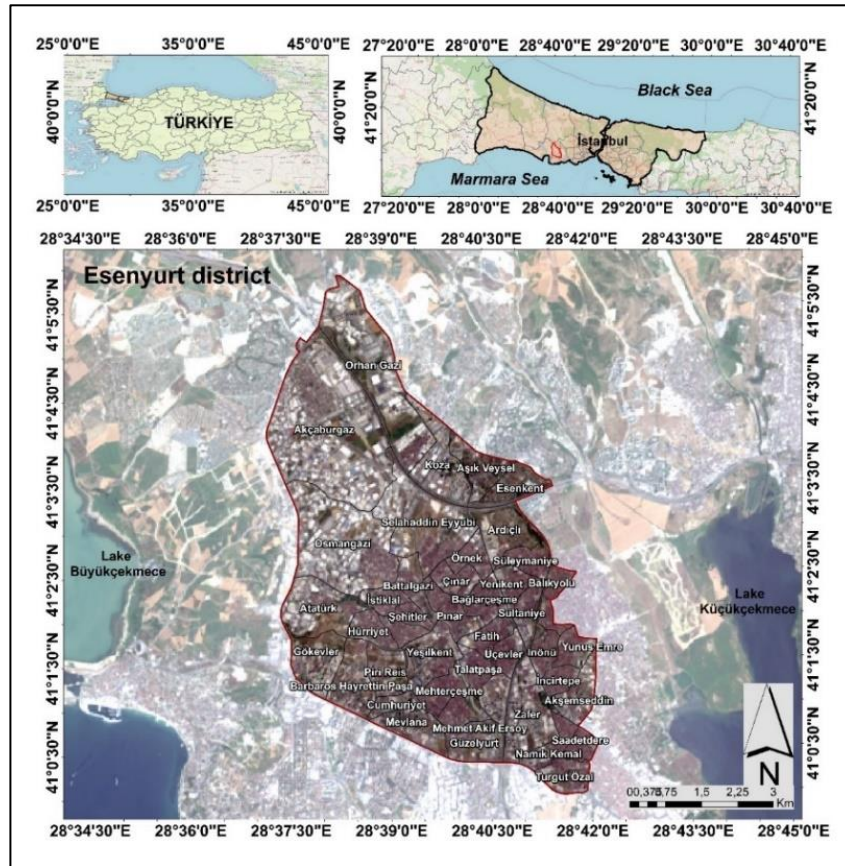


Figure 1. Location of the study area

The district boundaries of Esenyurt used in the study were sourced from www.openstreetmap.org (OpenStreetMap, 2023). In the study, Landsat 5 TM from 1990 and Landsat 8 OLI_TIRS image from 2018 were used to observe land use through NDVI and LST values. Care was taken to select images with a cloud cover of less than 10%. These images were downloaded for free from the US Geological Survey's website at <https://earthexplorer.usgs.gov/> (USGS, 2023). Calculations and map-making were carried out with the downloaded images using the ArcMap 10.8 program. Landsat images are among the most commonly used satellite images for LST calculations. The features of the used images are presented in Table 1.

Table 1. Features of the Landsat satellite image used in the study

Product_ID	Sensor_ID	Path/Row	Date_Acquired	Cloud_Cover (%)
LT05_L1TP_180032_1 9900731_20200915_02 _T1	TM	180/32	1990-07-31	<10
LC08_L1TP_180031_2 0180423_20200901_02 _T1	OLI_TIRS	180/31	2018-04-23	<10



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2.2. Methods

The methodology of this study consists of three stages. These are: calculating the NDVI value, calculating the LST value, and determining land uses.

2.2.1. Calculation of Normalized Difference Vegetation Index (NDVI) values

This index is one of the commonly used indices for mapping vegetation (Zha et al., 2010). It was developed by Rouse et al. (1973). The calculated value ranges from -1 to +1. Values ranging from -1 to 0 indicate no vegetation, while values closer to +1 represent the highest green vegetation density (Ekumah et al., 2020). Values below 0 indicate water, snow, and clouds; values between 0 and 0.2 represent bare land/built-up areas/rocks; values between 0.2 and 0.5 signify a mixture of soil and vegetation; and values above 0.5 denote areas covered with vegetation (Avdan & Jovanovska, 2016). The NDVI formula is given in the following equation (Rouse et al., 1973):

$$NDVI = (NIR - Red) / (NIR + Red) \dots \dots \dots \text{eq (1)}$$

2.2.2. Calculation of Land Surface Temperature (LST) values

First of all, spectral radiance value conversion is applied to the thermal image band values (DN: Digital Number) to be used. In this equation: $L\lambda$: temperature of atmosphere spectral radiance, ML : band-specific multiplicative rescaling factor from the metadata, Q_{cal} : quantized and calibrated standard product pixel values (DN) and AL : band-specific additive rescaling factor from the metadata (Akyürek, 2020; Kumari et al. al., 2018).

$$L\lambda = ML * Q_{cal} + AL \dots \dots \dots \text{eq (2)}$$

After this conversion, the TIRS band data is converted from spectral radiance to brightness temperature (BT) using thermal constants. Results in Celsius are obtained by revising the radiation temperature by adding absolute zero (Avdan & Jovanovska, 2016). BT represents the brightness temperature in degrees Celsius. $L\lambda$ denotes spectral radiance. $K1$ is a band-specific thermal conversion coefficient (given as 774.8853). $K2$ is another band-specific thermal conversion coefficient (given as 1321.0789) (Güneş et al., 2021).

$$BT = \frac{K2}{\ln\left(\frac{K1}{L\lambda} + 1\right)} - 273.15 \dots \dots \dots \text{eq (3)}$$

After this step, the Normalized Difference Vegetation Index (NDVI) must be calculated in order to determine the Earth's surface emissivity and vegetation ratio. In determining the LST, NDVI values should be obtained from reflectance values, not DN values (Akyürek, 2020). (eq (1)). After calculating the NDVI value, the proportion of the vegetation (P_v) is calculated using Equation 4. Then, the land surface emissivity LSE (ϵ) value suggested by Sobrino et al.(2004) is calculated using equation 5 (Kumari et al., 2018).

$$P_v = ((NDVI - NDVI_{MIN}) / (NDVI_{MAX} - NDVI_{MIN}))^2 \dots \dots \dots \text{eq (4)}$$

$$\epsilon = 0.004P_v + 0.986 \dots \dots \dots \text{eq (5)}$$

After calculating the LSE (ϵ) value, the last step is to calculate the LST value.

$$LST = \frac{BT}{1 + \left[\frac{\lambda BT}{p} \right] \ln \epsilon \lambda} \dots \dots \dots \text{eq (6)}$$



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Wavelength $\lambda=10.895$ is used while calculating LST as Celsius ($^{\circ}\text{C}$), and BT is at-sensor BT ($^{\circ}\text{C}$) (Avdan & Jovanovska, 2016). The ρ value here is a fixed value and is calculated with the help of the formula given in equation 7:

$$\rho = h * c/s = 1.438 \times 10^{-2} \text{ mK} \dots \dots \dots \text{eq (7)}.$$

(h: Planck constant (6.626×10^{-34} Js), s: Boltzmann constant (1.38×10^{-23} J/K), c: Speed of light (2.998×10^8 m/s) (Akyürek, 2020).

2.2.3. Determination of Land Uses

In the study, the Urban Atlas data for the year 2018 was used to evaluate the relationship between LST values and land use status. The Urban Atlas data of the European Environment Agency (EEA) is produced from CORINE data, which is arranged semi-automatically and manually and is presented in the Copernicus Land Monitoring Service data portal. While CORINE data covers the entire country, urban atlas data only covers urban areas and therefore has a higher resolution. It has a resolution 100 times higher than CORINE data, making the urban atlas data more accurate for studies where land changes are observed (Aksoy et al., 2022).

3. FINDINGS and DISCUSSION

3.1. The Situation of Esenyurt District in the Historical Process

When the period after 1970 is examined, one of the most important turning points for Esenyurt occurred with the Grand Istanbul Master Plan approved in 1972. Accordingly, the positioning of Esenyurt next to the new highway and showing it as a settlement area for 100,000 thousand people has made the district a center of attraction in the field of housing and industry. After these dates, the process of land acquisition started with the increase in population. Later, with the population increase in Esenyurt, it was decided to establish a municipality of 6 neighborhoods with the same name in Esenyurt Village, with the decision numbered 87/34092 dated 21 December 1987. Esenyurt, whose growth accelerated in the early 2000s, became the new district of Istanbul by incorporating Kıraç on March 6, 2008 (Esenyurt Municipality, 2019).

After gaining the status of a district, Esenyurt, which initially had 20 neighborhoods, increased its number of neighborhoods to 43 based on a decision taken by the Esenyurt Municipal Council on December 5, 2014 (Ayhan, 2019). The district's population, which stood at 70,280 in 1990, grew to 891,120 by 2018 (TUİK, 2023). Based on the 2018 population data, the Pınar neighborhood is the most densely populated area of the district. Furthermore, the neighborhoods of Mehterçeşme, Yeşilkent, Süleymaniye, Os mangazi, Bağlarçeşme, Çınar, Balık yolu, and Talatpaşa each account for more than 3% of the district's total population. Therefore, these neighborhoods are also considered major residential areas in terms of population scale (Esenyurt Municipality, 2019). Satellite images of Esenyurt for the respective years, along with the spread of its residential areas, are provided in Figure 2.

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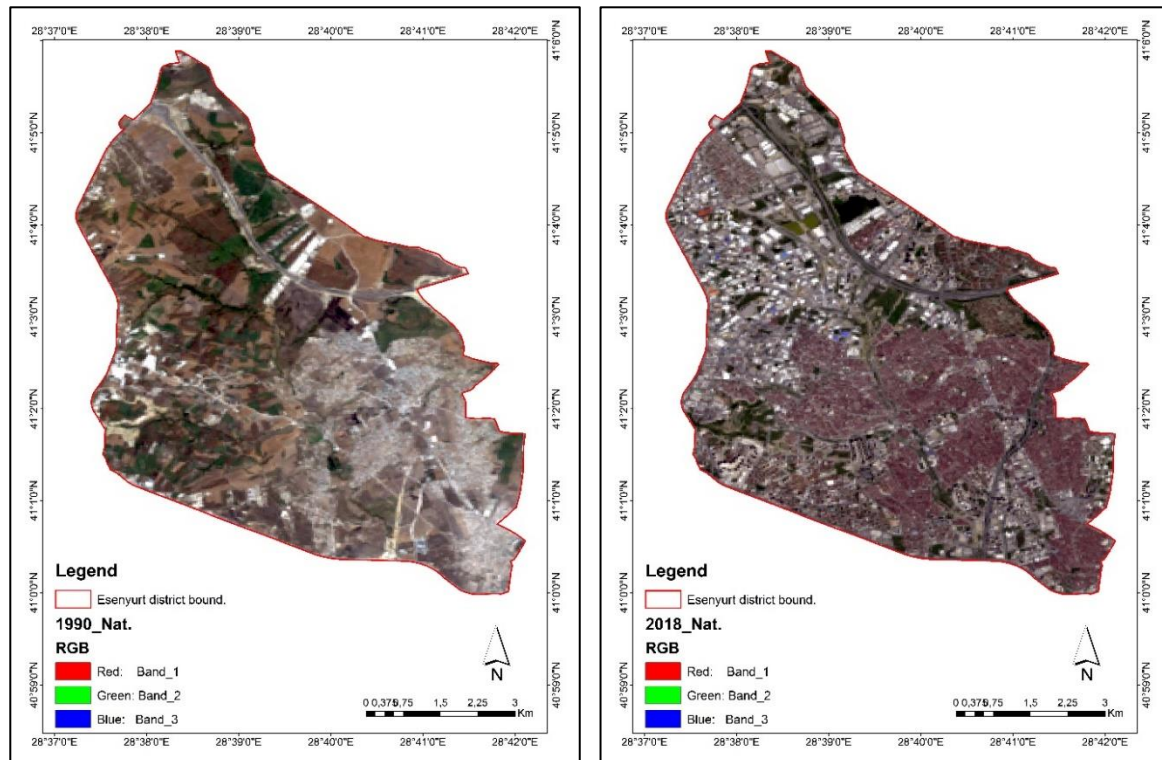


Figure 2. Landsat satellite images of Esenyurt district for the years 1990 and 2018 (Landsat 5, B3, B2, B1 natural band combinations and Landsat 8 B4, B3, B2 natural band combinations, respectively)

3.2. Findings on NDVI Analysis

Descriptive statistics of NDVI calculated with Landsat 5 and Landsat 8 images from 1990 and 2018 provided within the scope of the study are shown in Table 2.

Table 2. NDVI statistical results of Esenyurt district for the years 1990 and 2018

	Min	Max	Mean	Standard dev.
NDVI 1990	-0,12605	0,65672	0,13271	0,12037
NDVI 2018	-0,12428	0,58067	0,12626	0,11432

Accordingly, for 1990, NDVI min. was calculated as -0,13 and NDVI max was calculated as 0,66. For 2018, NDVI min was calculated as -0,12 and NDVI max was calculated as 0,58. According to the NDVI results, the average value was 0,13 for both years. When the results were evaluated, it was seen that the vegetation areas, which represent the highest density as they approached +1, decreased from 1990 to 2018. When Figure 3 is examined, it is understood that vegetation areas were low density in many neighborhoods of the district in 2018.

When the map given in Figure 4 is examined, it is seen that the NDVI value shows the lowest values in the central neighborhoods, which are densely populated in the settlements in the

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district center. However, the NDVI value is also low in some parts of the northern part, where large industrial areas are located.

In addition, according to the NDVI results, for the year 1990, 3.158,35 ha of the study area were calculated as bare land/built-up areas/rocks, while vegetation areas were calculated as 66,64 ha (Figure 4). For the year 2018, bare land/built-up areas/rocks were calculated as 3.410,95 ha, while areas with vegetation were calculated as 33,33 ha.

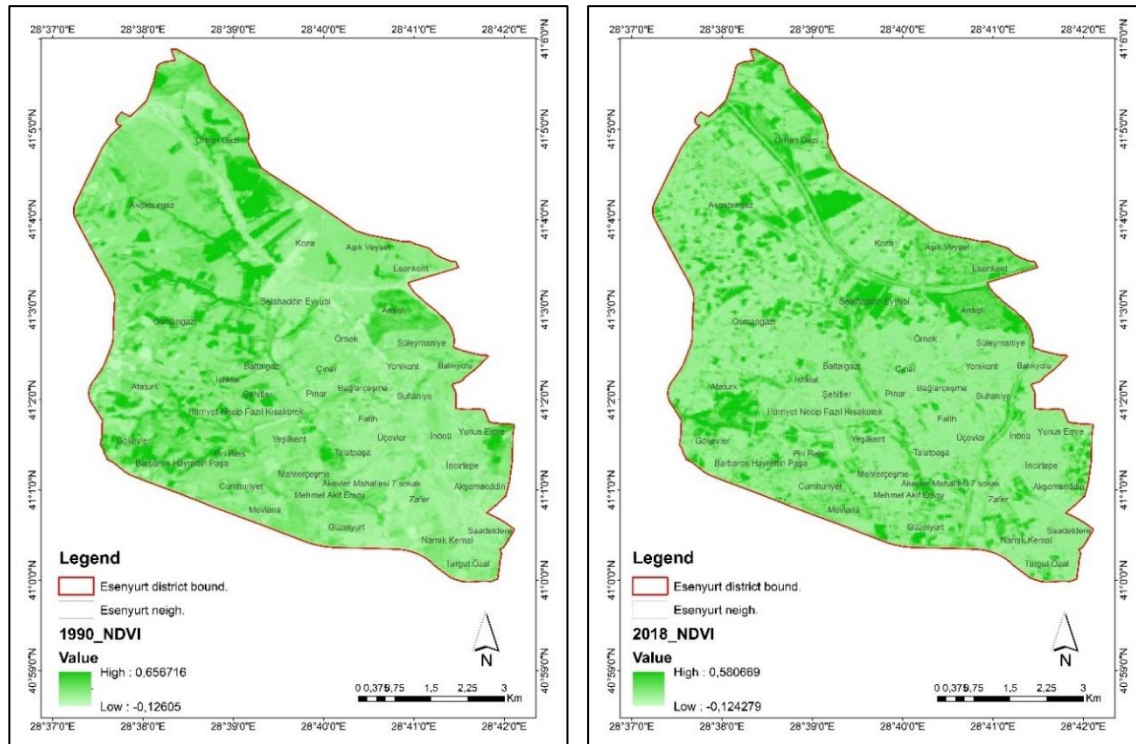


Figure 3. NDVI Maps of Esenyurt District for the years 1990 and 2018

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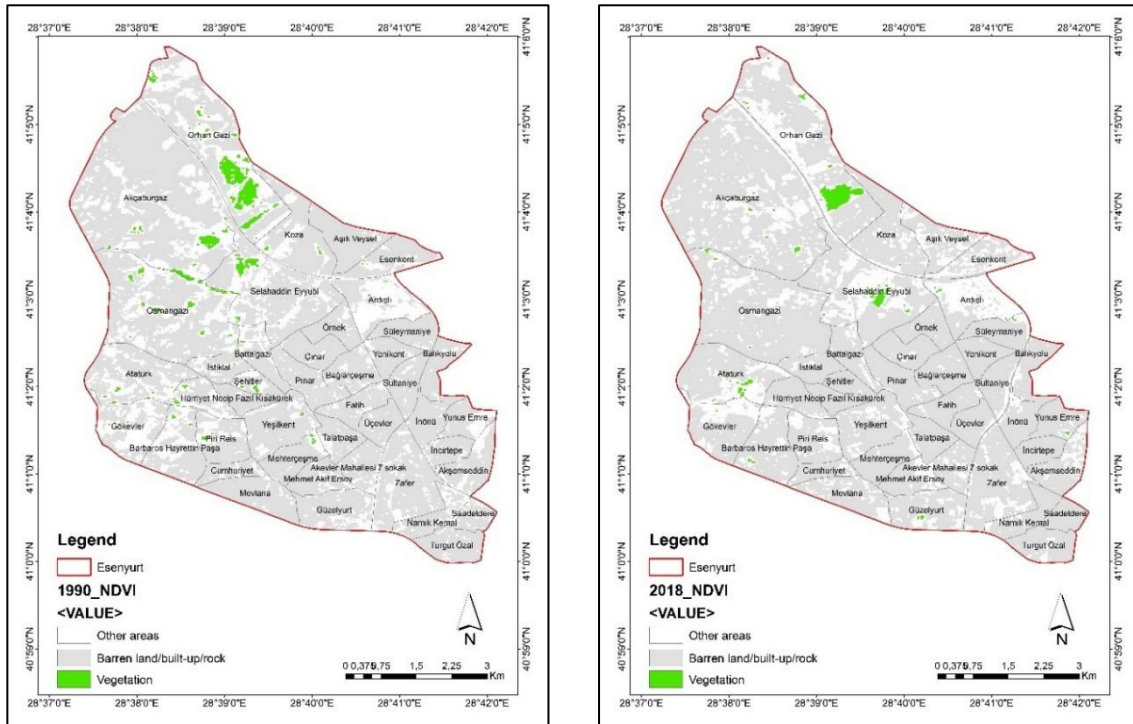


Figure 4. NDVI class maps of Esenyurt district for the years 1990 and 2018

3.3. Findings on LST analysis

Using Landsat 5 and Landsat 8 satellite images, land surface temperature maps of the study area for the years 1990 and 2018 were produced by applying the process steps explained in land surface temperature calculations (Figure 5). Land surface temperature values varied between 16.1°C and 38.0°C for 1990. Land surface temperature varies between 21.6°C and 41.7°C in 2018. According to these results, the maximum temperature difference in the area between 1990 and 2018 is 3.7°C and the minimum temperature difference is 5.5°C.

When examining land surface temperature values, especially those above 30°C, it is observed that for the year 1990, these values were distributed in the newly developed areas and vacant lands in the northeast and southern parts of the district. For 2018, especially in the southern parts of the district where there is a significant amount of construction, neighborhoods such as İstiklal, Hürriyet, Necip Fazıl Kısakürek, Şehitler, Battalgazi, Pınar, Çınar, Örnek, Bağlarçeşme, Fatih, Üçevler, Talatpaşa, Mehterçeşme, Mehmet Akif Ersoy, Süleymaniye, Yenikent, Sultaniye, Balık Yolu, İnönü, Yunus Emre, İncirtepe, and Saadetdere were observed to have higher temperatures than their surroundings. These findings are significant in showcasing the urban heat island effect in these neighborhoods. On the other hand, in the district where the large-scale green space is quite limited, the lowest land surface temperatures have been calculated for green areas. These areas include the Gülbahçe cemetery in the northeast of the district, the Esenyurt picnic area, and other open green spaces. In these regions, temperatures have been observed to drop as low as 21°C.

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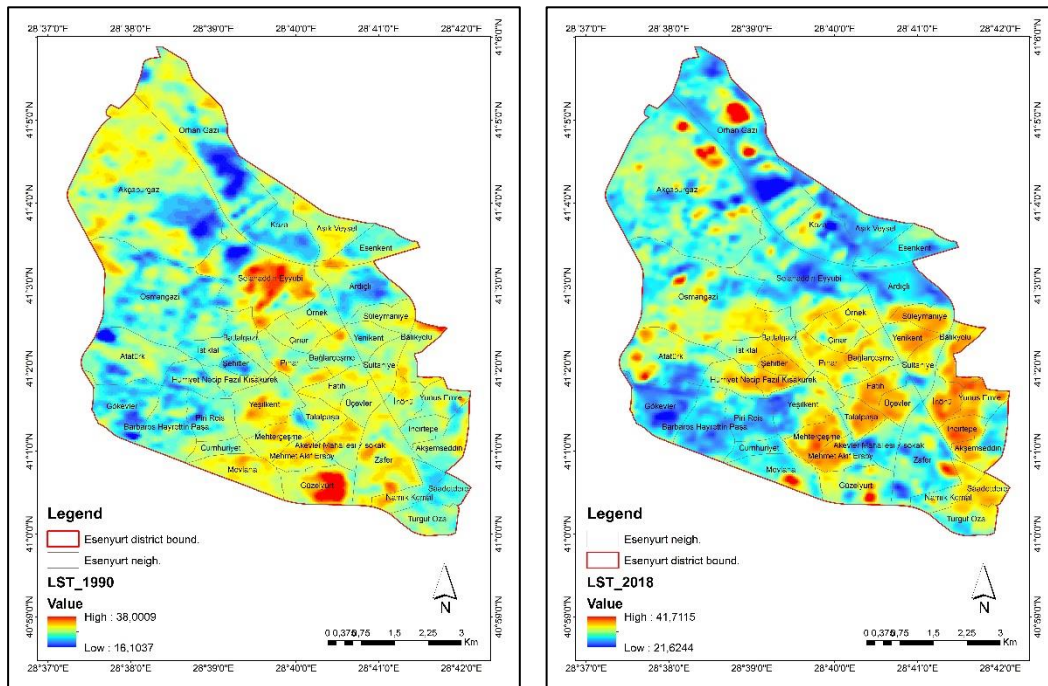


Figure 5. LST maps of Esenyurt district for the years 1990 and 2018

3.4. Investigating the relationships between NDVI and LST

To explain the relationship between land surface temperature (LST) and the Normalized Difference Vegetation Index (NDVI), which is used to understand land use changes, a correlation analysis was performed. For the evaluation of the results from the years 1990 and 2018, a correlation analysis was carried out using 488 randomly selected points. These relationships can be seen in Figure 6. The results indicate that in areas where land surface temperatures are lower, NDVI values are higher. The correlation analysis results show that the LST has a negative correlation relationship with NDVI. The correlation coefficient between LST and NDVI was calculated as $r=-0.477975581$ for 1990 and $r=-0.52422$ for 2018. The negative correlation finding related to NDVI in this study is consistent with the findings of previous studies (Karakuş, 2019; Alademomi et al., 2022; Moisa et al., 2022).

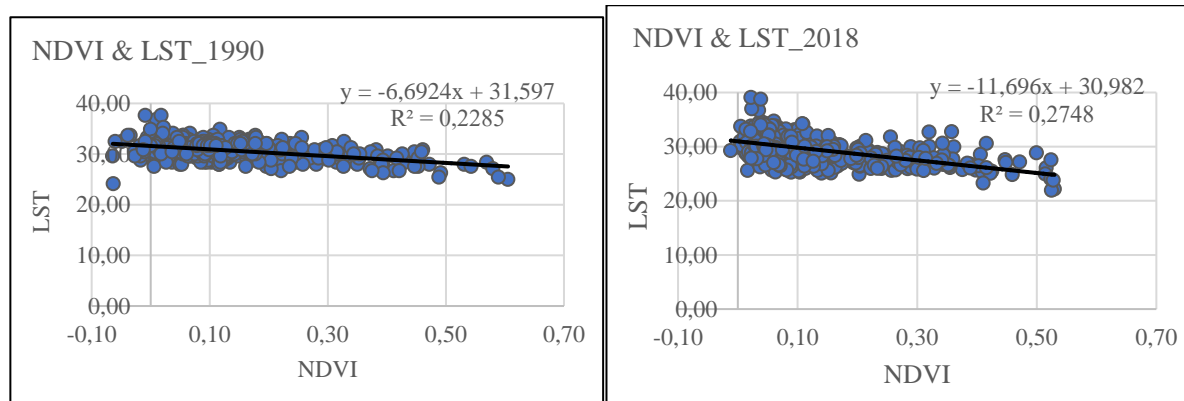


Figure 6. Correlation results for NDVI and LST values of Esenyurt district for the years 1990 and 2018



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3.5. Investigating the relationships between land uses and LST

In the 1980s, Esenyurt had open lands where dry farming was practiced. However, today, these areas have largely been urbanized and transformed into plots. The district, which lacks a distinctive vegetative cover, has greenery mainly in areas that have been landscaped along roadsides and designated as parks (Esenyurt Municipality, 2015).

Land uses of Esenyurt district in 2018 were evaluated through Urban Atlas data (Table 3, Figure 7). Accordingly, it was seen that the continuous urban fabric coded 11100 covers 797,70 ha and these areas constitute 18,51% of the total area. It was observed that the discontinuous urban fabric covers 600,52 ha and these areas constitute 13,94% of the total area. Accordingly, continuous and discontinuous urban fabric covers a total area of 32,45% in the district. On the other hand, it was observed that the industrial areas with the code 12100, which include industrial, commercial, public, military and private units, which constitute a large part of the district, cover 1.420,97 ha and these areas constitute 32,98% of the total area. Due to the location of the district, the highways passing through it and forming borders and other related uses cover 606,23 ha in the district, and these areas cover 14,07% of the total area. Green urban areas in the district cover 152,65 ha and these areas constitute 3,54% of the total area. The arable lands and pastures in the district cover 292,46 ha and these areas constitute 6,79% of the total area. The areas representing herbaceous vegetation associations coded 3200 cover an area of 66,85 ha and these areas constitute 1,55% of the total area. These results are important as they show that 91,66% of the district, with 3.949,11 hectares, is covered with artificial areas and that natural areas are quite inadequate in the district.

Table 3. Land use distribution according to 2018 Urban Atlas data for the Esenyurt district

Main Class	UA_codes	UA_class	Area (ha)
Artificial Areas	11100	Continuous urban fabric	797,70
	11210	Discontinuous dense urban fabric	470,37
	11220	Discontinuous medium density urban fabric	68,72
	11230	Discontinuous low density urban fabric	28,26
	11240	Discontinuous very low density urban fabric	33,17
	12100	Industrial, commercial, public, military and private units	1.420,97
	12210	Fast transit roads and associated land	43,66
	12220	Other roads and associated land	562,57
	13100	Mineral extraction and dump sites	18,06
	13300	Construction sites	152,22
	13400	Land without current use	172,72
	14100	Green urban areas	152,65



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	14200	Sports and leisure facilities	28,04
Agricultural Areas	21000	Arable land (annual crops)	101,54
	23000	Pastures	190,91
Natural Areas	32000	Herbaceous vegetation associations	66,85

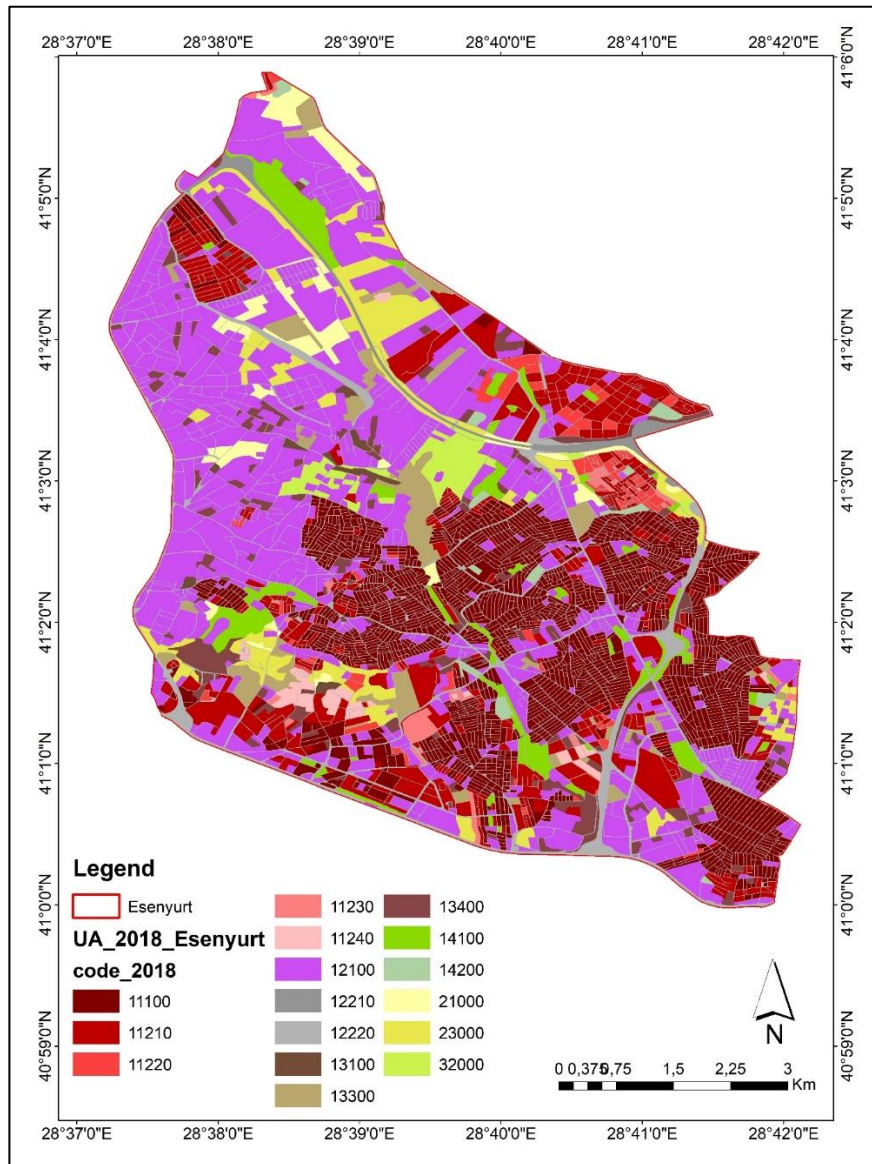


Figure 7. Land Use Map According to 2018 Urban Atlas Data For Esenyurt District

According to the 2018 Urban Atlas data for Esenyurt district, cross-sections were taken and evaluated in order to understand the relationships between land uses and LST. Looking at Figure 8, it can be seen that the land surface temperature decreases in areas located on green areas, and reaches the highest value in areas where residential areas are located. In addition, the LST value is high in bare lands. These findings were parallel to the findings of some researchers (Zhou et al., 2011; Sun et al., 2012). As a matter of fact, it has been shown that the LST value

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increases in built areas and bare lands where urbanization is concentrated and these regions have higher land temperatures.

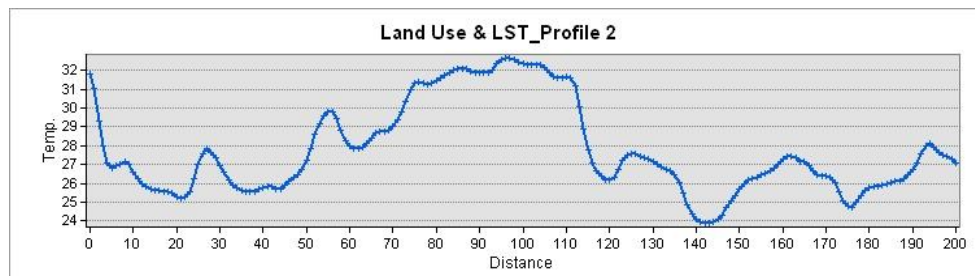
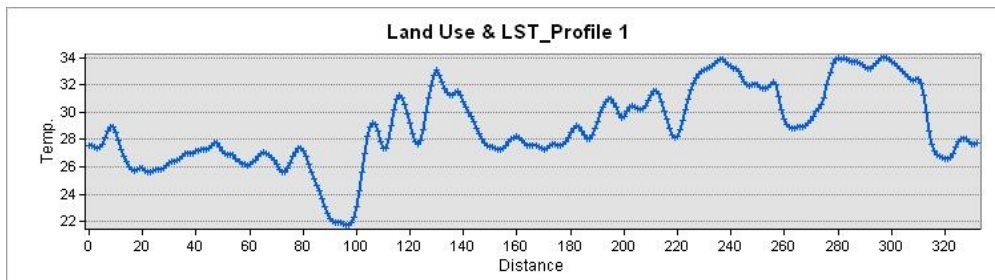
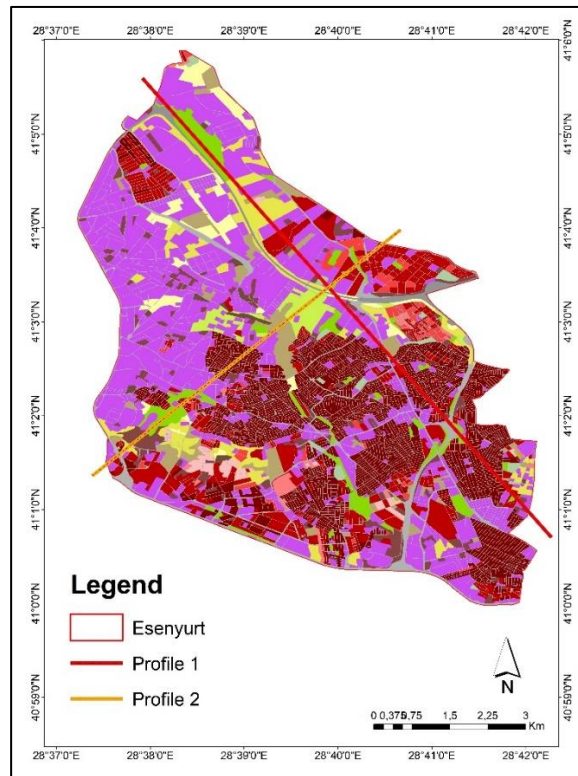


Figure 8. Sections showing land uses and LST relationships according to 2018 Urban Atlas data for Esenyurt district

4. CONCLUSION and RECOMMENDATIONS

In this study, which deals with the Esenyurt district of Istanbul, it is revealed how the land use change in the district in the 28-year period between 1990 and 2018 affected the region in terms



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of LST and vegetation. Accordingly, the LST value differed in cultivated lands, bare lands, areas covered with vegetation and built-up areas. In this context, studies emphasize that urban heat island effects can be reduced by implementing appropriate land use planning (Kleerekoper, et al., 2012; Sun et al., 2012). Kleerekoper, et al. (2012) summarized that the way to do this in cities is through arrangements to be made in vegetation, water, built environment and material use. In this context, increasing vegetation cover is one of the most effective ways to reduce the LST value (Ferguson & Woodbury, 2007; Moisa et al., 2022).

In the study, the urban heat island effect was also investigated using the LST value. In this context, classes expressing land uses were determined using the 2018 Urban Atlas maps. It has been observed that the areas with the highest distribution are industrial areas. When the relationships between the calculated LST values and land cover were examined, it was seen that LST reached the highest value on artificial surfaces. These areas are the district center where continuous and discontinuous urban fabric areas are located. It was observed that the LST value reached its lowest value in natural areas covered with vegetation with herbaceous vegetation. It was determined that there was a moderate negative correlation between the NDVI (Normalized Difference Vegetation Index) value calculated in the study and LST.

When the findings regarding LULC, NDVI and LST in this study were evaluated together, it was concluded that the surface temperature increased in urban areas and decreased in areas with vegetation. These results also show heat island effects in urban areas. These urban heat island effects are especially in the neighborhoods with high population density of the district: İstiklal, Hürriyet, Necip Fazıl Kısakürek, Şehitler, Battalgazi, Pınar, Çınar, Örnek, Bağlarçeşme, Fatih, Üçevler, Talatpaşa, Mehterçeşme, Mehmet Akif Ersoy, Süleymaniye, Yenikent, Sultaniye. It was seen to be effective in Balık Yolu, İnönü, Yunus Emre, İncirtepe, Saadetdere (Figure 8).

With the increasing population, urban areas are expanding and growing every day. As cities grow and develop, it is understood how crucial the presence of green areas in newly planned areas is to minimize the urban heat island effect. Particularly in the example of Esenyurt, it is clear that the formation of areas that are limited in green spaces compared to the population, and have surrendered to the dominance of construction, negatively affects both the city and its inhabitants in many ways. This situation primarily causes adverse conditions ecologically, impacts the urban comfort of individuals, poses health threats, and affects the welfare level in various aspects such as cultural, social, and economic. This, in turn, disrupts the structure of the city by creating other pushing forces, such as incitement to crime and vandalism. Therefore, when establishing cities, it is essential to be aware that multifaceted and multi-layered parameters exist at every step towards the growth and development of cities. A sustainable and systematic city structure should be established in interdisciplinary consensus, involving landscape architects, urban and regional planners, architects, ecologists, environmental engineers, sociologists, and more.

On the other hand, enhancing the diversity and density of green spaces in cities, supporting built-up areas with rooftop gardens and vertical garden applications, reducing impermeable surfaces, and emphasizing the use of ecological materials are among the measures that can be taken. Additionally, high temperatures have negative effects such as reducing thermal comfort, bringing forth health risks, and decreasing the quality of life. Implementing such measures in cities is essential to minimize these effects. Furthermore, this issue is vital for creating sustainable and ecological living spaces, thereby ensuring sustainable development.



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In conclusion, this study analytically presents the environmental consequences of urbanization, especially in areas where urbanization is progressing rapidly, using the district of Esenyurt as an example. It is believed that these findings will provide valuable data for state units associated with urban planning, local governments, and other stakeholders in terms of urban planning and management for new planning initiatives.

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NATURALNESS AND NATURALIZATION STUDIES FOR LIVABLE CITIES

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ABSTRACT

Today, the urban-rural balance is developing and differentiating dramatically at the expense of natural areas-rural areas. With the increasing population and global economic mobility, a large part of the planet is shaped by human hands, and the emphasis expressed by scientists and experts is that cities will move away from being livable environments due to global climate change. As a solution, it is mentioned that the necessity of re-establishing the relationship of cities with nature is vital. Cities are ecosystems that contain natural structures and systems, and that involve the interaction of cultural and natural structures, in addition to being areas where anthropogenic activities are concentrated. Therefore, cities must maintain their ecosystem functions in a balanced and healthy way with planning practices that address cities with the perception of ecosystems. The Urban Paradigm Shift brings to the fore a "Nature-Oriented" urban scenario and emphasizes that cities, which are places of differences, protect ecosystems, water, natural habitats, and biodiversity; it is foreseen that there will be settlements that support sustainable consumption and production forms. In this paper, examples that will contribute to the improvement of the quality of life in a range based on nature-based solutions in urban design processes and that can be considered from energy-efficient structures to water-permeable surface coating materials will be included. To ensure the sustainability of cities, examples will be included where the functioning of different ecosystems (streams, agriculture, built environment, etc.) from natural to man-made ones find application in the city and its immediate surroundings and are reflected in design decisions. The fact that urban design projects prepared under the guidance of green infrastructure systems and nature-based solutions make a significant contribution to the solution of problems in detail and practice and that design concepts such as water-sensitive urban design (WSUD) and landscape urbanization (LU) are developing in this direction, will be evaluated in the determination between the different components in the urban spatial organization. In addition to the necessity of interdisciplinary work and cooperation between solutions in the specified design approaches, the subject will also be examined with examples in bio-engineering studies where relevant engineering fields are also involved in the design processes, especially in the development of system details.



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Keywords: City, Nature, Naturalness, Urban Ecology, Green Scenario, Naturalization.

1. INTRODUCTION

Today, the urban-rural balance is developing and differentiating dramatically at the expense of natural areas-rural areas. Natural environmental conditions are the main factors in the establishment of cities (Yaman & Doygun, 2014). The data arising from the location, topographical situation, climatic conditions, water elements, vegetation and natural environment of a city distinguish it from others, define it, make it unique and give identity to the city (Deniz, 2004; Kır, 2009).

Cities are ecosystems that contain natural structures and systems, and that involve the interaction of cultural and natural structures, in addition to being areas where anthropogenic activities are concentrated (Can, 1999; Uçkaç, 2006). Therefore, cities must maintain their ecosystem functions in a balanced and healthy way with planning practices that address cities with the perception of ecosystems. The Urban Paradigm Shift brings to the fore a "Nature-Oriented" urban scenario and emphasizes that cities, which are places of differences, protect ecosystems, water, natural habitats, and biodiversity; it is foreseen that there will be settlements that support sustainable consumption and production forms.

For the ecological, social and economic sustainability of our country's cities, green network systems will come to the fore as "critical infrastructures" in today's volatile and fragile urban environment. Green network and green infrastructure studies are on the agenda to analyze and integrate the ecologically based systems within our cities (Demirel & Velibeyoğlu, 2017). Despite the overgrowing/identifying structure of cities, the elements that make the city more unique, livable and with identity are green network systems, which can be defined as the ecological values of the city. The concepts of "green scenario" and "city within nature", which have been expressed in cities in recent years, are a natural result of these obligations and searches. In this sense, establishing green infrastructure networks and considering relevant nature-based design solutions will facilitate the process as a proactive step.

The fact that urban design projects prepared under the guidance of green infrastructure systems and nature-based solutions make a significant contribution to the solution of problems in detail and practice and that design concepts such as water-sensitive urban design (WSUD) and landscape urbanization (LU) are developing in this direction, will be evaluated in the determination between the different components in the urban spatial organization (Demirel & Oruçkaptan, 2018). In addition to the necessity of interdisciplinary work and cooperation between solutions in the specified design approaches, the subject will also be examined with examples in bio-engineering studies where relevant engineering fields are also involved in the design processes, especially in the development of system details.

2. Natural Environment and Occurrence of the Problem

The natural environment, or natural world, includes all living and inanimate beings that have come into being only by natural means. There are no completely natural environments on Earth. The opposite of the natural environment is the human environment. The human environment is where humans have transformed areas such as urban environments and farmland from the very beginning, and these places have been transformed by man into a substantially simpler human environment than the natural environment (URL, 2023a).

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Global economic changes underlie the ongoing changes in the role of cities. Over the past fifty years, most cities in developing countries have grown with industrialization and subsequent urbanization practices (Sassen, 1998), and today's cities cover 2% of the earth's surface but consume 75% of the world's resources (Wiemann, 1996). Again, as a result of the solution of the housing and housing problem, which is the basic human need that manifested itself in the 20th century, through slumming and concreting in the aforementioned cities, irregular and unplanned urbanization, urban infrastructure and urban environment problems have emerged.

3. Compliance Process

In addition to being areas where anthropogenic activities are concentrated, cities are ecosystems that contain natural structures and systems, and involve the interaction of cultural and natural structures (Figure 1). Today, the urban-rural balance differs dramatically in favor of the cities. Depending on the effects of global climate change, the heat island effect, air pollution, flood disasters, green space deprivation, distribution and maintenance problems, biodiversity loss, desertification, drought and related deteriorating soil and water quality, food security show that the relationship of cities with nature needs to be reconsidered (Demirel & Oruçkaptan, 2018).

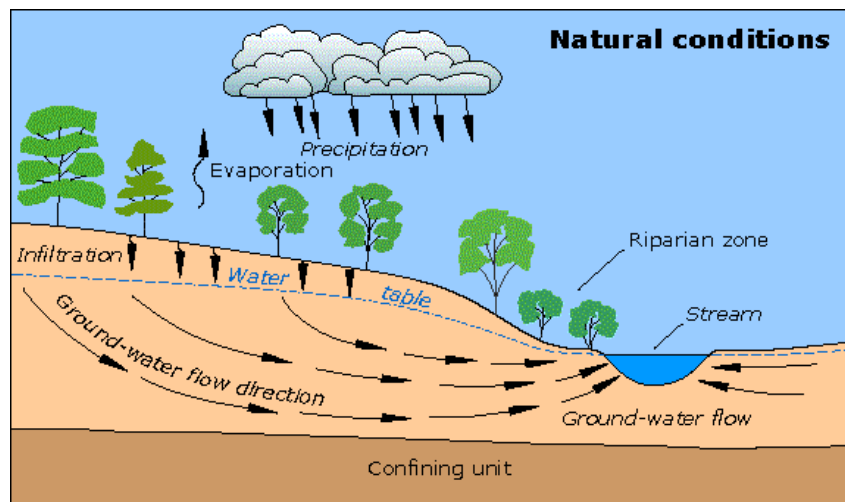


Figure 1. Formation of groundwater in natural conditions (URL, 2023b).

4. Urban Areas

There is a relationship between urban fabric organizations and infrastructure systems in urban areas.

- This relationship is particularly related to the decline of green spaces in urban areas and
- It has become even more important with the preference of impermeable surface coatings.

As a result of these preferences, superficial flow has occurred in transportation and construction and urban landscape areas. In parallel, the existing infrastructure systems, which continue with their limitations and problems, have become unable to manage water at high amounts and speeds with sudden rainfall.



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Today, the question of how to achieve harmony between the cities that are the scene of intensive human use and ecology is sought to be answered, pushing all the interest groups that make up the city to think and question multi-dimensionally on the *concept of "ecological urban renewal and livable healthy city"* (Demirel, 2017).

Urban Planners, Landscape Architects and ecologists strive to recreate the natural values that have been diminished and lost within the city. The concept of "all green network elements covering the built environment and open spaces that exist within the city" is a natural consequence of these necessities (Figure 2).



Figure 2. Reducing urban heat islands (URL, 2023c)

- Management of high temperatures
- Water resources management
- Reducing the impact of river floods
- Reduction of soil erosion
- Coastal flood mitigation
- Living species need to create a space to adapt to new climatic conditions.

5. Solutions

Urban Criteria and Performance Indicators (Işıldar, 2012)

1/*Urban Sustainability Indicators* ": It is the first example to use the European Charter on Sustainable Cities and Towns as a framework. Steps were taken at the 1994 Aalborg Conference. It was developed within the framework of a study by Mega and Peterson's European Foundation.

2/*"International Eco-City Framework and Condition Levels"* document (IEFS) is prepared by "Eco City Builders" and established in 1992 and gathers many related organizations (national-international) under its umbrella.



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3/Green City Index: It was prepared by Siemens together with the Economist Intelligence Unit (EIU) based on the view that the responsibility for climate change lies with the cities.

Eco-Cities

Eco-cities, which have emerged with the aim of adding a new meaning to the city in the ecological sense, are system designs that bring together all the point solutions that come to mind for the city. Eco-cities, which are seen as the cities of the future with the principles of ecological approach respecting nature, aim to add a new dimension to the understanding of the city (Çetinkaya, 2013).

What is wanted to be achieved with the Eco-City Model is to provide multifaceted benefits from nature without disturbing the natural ecological balance and to implement them on the condition that they are at optimum level. The objectives of the eco-city system are: (Quoted from Çetinkaya 2013/ Berkes & Kışlalıoğlu, 2010).

- Reducing the Impact of the City on the Environment
- Use of Renewable Energy Sources
- Low Waste Production
- Use of Recycled Materials
- Minimizing the Ecological Footprint

This process, which started with the I.Habitat Conference (1976, Vancouver), has been addressed in an increasingly important dimension today with the Quito Declaration on "Cities for All" (17-20 October 2016, Quito, Ecuador/U.N., 2016) and great strides have been made for the livability of cities in a 40-year period. With the Quito Declaration which has *the vision of "environmental sustainability"* urbanization is today considered as the engine of sustainable and inclusive economic development, social and cultural development, nature and environmental *protection, sustainable development*. In the Ecological Urban Renewal and Naturalization studies, the ecological interventions given and conceptualized below and the way of managing natural components with the perception of ecosystems are given (Figure 3).

CONCEPTUALIZATION

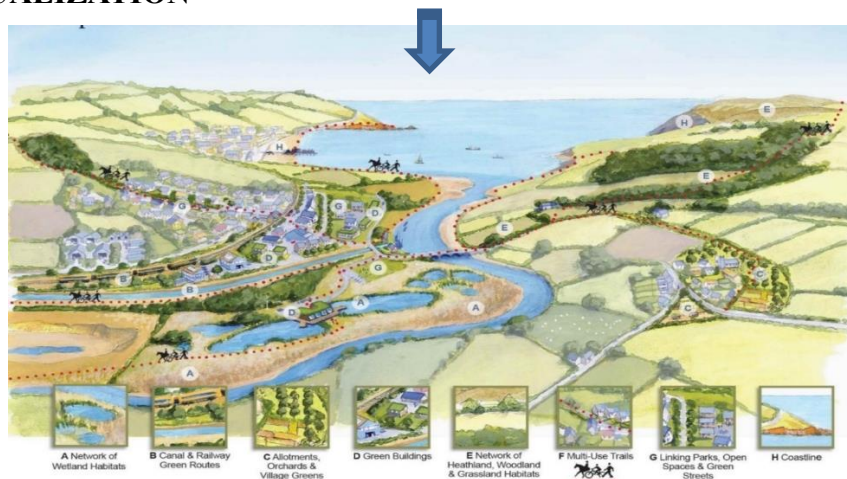


Figure 3. Ecological interventions and their conceptualized (URL, 2023d).

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A/ Network of Wetland Habitats

Habitat connectivity is a landscape feature that is critical to biodiversity conservation in the face of climate change. Describes the ability of species to disperse or move between suitable pieces of habitat (URL, 2023e).

There has been a recent emphasis on new strategies for identifying and assessing the quality of wetland habitat linkage for wildlife. The graphic-theoretical approach treats wetlands as nodal points for mapping habitat connectivity and defining habitat networks (Figure 4) for ecological analysis. Examples of other approaches are given in Figure 5-11.

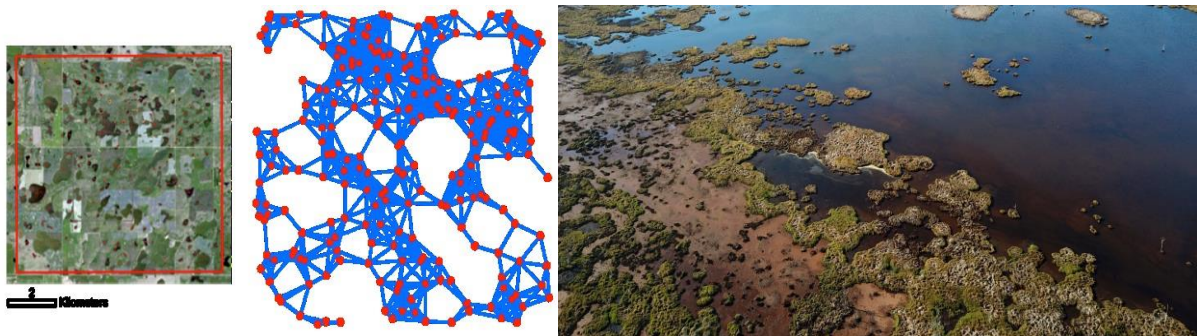


Figure 4. Network of wetland habitats (URL, 2023f).

B/ Canal & Railway Green Routes



Figure 5. Canal & Railway Green Routes (URL, 2023g).

C/ Allotments, Orchards & Village Greens / Allocated Plots



Figure 6. Allotments, Orchards & Village Greens / Allocated Plots (URL, 2023h).

D/ Green Buildings

In order to ensure and encourage the spread of the application of green buildings; Green building evaluation systems, for example certification systems, have been developed by green building councils around the world that confirm the sustainability of buildings within the



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framework of a number of standards (Akça, 2011). The main green building certificate systems developed by different countries (Sev and Canbay, 2009);

- 1990 England (BREEAM),
- 1996 Canada (SBTOOL),
- 1998 United States (LEED),
- 2003 Australia (GREENSTAR),
- 2004 Japan (CASBEE)
- 2007 German Council for Sustainable Building (DGNB),
- 2021 Turkey National Green Building and Green Settlements System (YES-TR)

Some examples can be seen in Figure 7.



Figure 7. Zorlu Center, Erke Green Academy and Sabancı University Nanotechnology Center (URL, 2023i-j)

E/Network Woodland, Heathland and Grassland



Figure 8. Network woodland, heathland and grassland (URL, 2023k).

F/Multi-Use Trails/Multi-Purpose Trails/Eco-Friendly Transportation



Figure 9. Multi-use trails/multi-purpose trails/eco-friendly transportation (URL, 2023l)



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G/ Linking Parks, Open Spaces and Green Streets



Figure 10. Linking parks, open spaces and green streets (URL, 2023m).

H/Coastline



Figure 11. Coastline (URL, 2023n).

The Final Word

Landscape Architects and Urban Planners, are to recreate the natural values that have decreased and disappeared within the city.

The concepts of "green scenario" and "city within nature« that have been voiced in cities in recent years are a natural result of these necessities and searches.

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**ROUTES AND TRACES: THE ROLE OF CONSTRUCTION MATERIALS IN
SHAPING THE PEDESTRIAN-FRIENDLY URBAN ENVIRONMENT**

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ABSTRACT

The physical environment of a city can have a significant impact on how people use and navigate through urban space. The construction materials play a crucial role in shaping the urban environment, pedestrian routes and experiences. One important factor in this regard is the material used for construction. Concrete, asphalt, brick, terrazzo and other materials all have unique aesthetics and tactile qualities that can influence the flow of pedestrian traffic and create distinct experiences within urban areas. The relationship between urban space, construction material, pedestrian traces and routes is complex and multifaceted. An approach to the use of construction materials can create a diverse and dynamic landscape that enriches urban life and encourages community engagement. While each of these factors has its own unique influence on a place, they are also deeply interconnected and can combine in unexpected ways to create rich and evolving urban environments. In this context, the aim of the study is to explore the relationship between urban space, construction materials and pedestrian traces and routes. The research draws on existing literature on urban design, architecture and environmental psychology. The study is based on a critical analysis of case studies of urban spaces in different cities around the world. The analysis considers how the use of different construction materials affects the way pedestrians move and interact with their surroundings. The paper argues that the careful use of construction materials can improve pedestrian movement and contribute to the creation of a more walkable, vibrant and sustainable urban environment.

Keywords: Pedestrian-Friendly City, Routes & Traces, Urban Experience, Inclusive Design, Construction Materials.

1. INTRODUCTION

Urbanization has led to a significant increase in the population of cities around the world. This has created a number of challenges for urban planners and designers, who must find ways to accommodate the growing number of people in a relatively small space. One key challenge is to design urban environments that are pedestrian-friendly and encourage walking as a means of transportation.

Three main groups of determinants of pedestrian movement and place activities related to street characteristics and the built environment could be identified:



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1. Urban design and land use are of utmost importance for achieving high levels of pedestrian activities in the streets.
2. Streetscape design also matters.
3. The successful provision for pedestrian movement and place activities requires far more than pedestrian-focused urban and transport design (Gerike et al, 2021).

Measures aimed at improving pedestrian traffic conditions should be undertaken in a comprehensive manner and in parallel on many levels. This mainly applies to the implementation and improvement of street optimization standards, providing more space for pedestrians and functions that activate the public space. What is needed is spatial planning oriented on the development of pedestrian and public transportation as well as urban traffic organization based on the priority of pedestrian traffic and public transport (Wiszniewski, 2018).

The pedestrianisation strategy aims to revitalize city centres by creating a pleasant and functional public space, encouraging people to move in public space and communicate. The environment and pedestrian streets in cities must be designed to encourage people to walk daily. The plan should encourage people to look for work close to home, use the services around them and become part of the local community. Together, these factors would reduce the use of private cars (Vugule, 2021). Reducing vehicle traffic in the city centre, speed limits, pedestrianization, and spatial interventions that provide safe and comfortable access for pedestrians improve the walking experience, and shape the expectations and priorities of pedestrians regarding a walkable environment (Erturan & Aksel, 2022).

The speed of pedestrians, the perception of users, and the geometric-functional evaluation are useful parameters for the planning of pedestrians' structures. During the last few years, it has been quite difficult for designers to understand the relationship between the characteristic pedestrian flow and the pedestrian movement using only their experience and their senses. Interactions between pedestrians are difficult to understand and often the presence of closed or small spaces alters their behavior. The planning and the design of spaces in which pedestrians can move as they do in streets and squares must be considered as certain parameters in order to increase the perception of safety in users and therefore to make them more usable. Among these parameters, streets are the spontaneous surveillance that increases the offender's apprehension given by the risk of being seen by people (Campisi et al., 2020).

Pedestrian traces left behind by people also have a significant influence on urban space. As people move through an environment, they leave behind physical marks and traces that can shape the appearance and function of a place. Pedestrian traffic patterns can help determine where paths and sidewalks are constructed and where access points and gathering spaces are located. The marks left by graffiti artists, street performers and other non-traditional users of urban space also contribute to the overall aesthetic of a place, creating a sense of character and identity that is unique to each location. The routes taken by people as they move through urban environments can shape the way space is used and experienced. By following particular paths, people can create connections and relationships to certain places, while avoiding others. This can create distinct spatial patterns and hierarchies that help define the overall character of a location.



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Construction material plays a crucial role in shaping urban space, as different materials can have significant impacts on the physical attributes of a place. For example, the use of concrete or glass can create sleek and modern-looking cityscapes, while the use of brick or stone can give buildings a more traditional and historic feel. The choice of architectural styles and building design can also have an impact on the form and function of urban spaces, from the sprawl of suburban municipalities to the dense clusters of high-rise buildings that dominate many metropolitan areas.

In this context, the purpose of this study is to explore the pivotal role that construction materials play in crafting pedestrian-friendly urban environments. By examining the impact of various materials on the physical, social and sensory aspects of urban spaces, it is aimed to shed light on the potential of construction materials to transform cityscapes into vibrant, accessible and engaging places for pedestrians.

The role of construction materials in shaping pedestrian-friendly urban environments extends far beyond their functional properties. They possess the power to influence the overall experience of pedestrians, contribute to environmental sustainability and foster social cohesion. Through a comprehensive examination of the relationship between construction materials and the urban realm, this study aims to inspire and inform urban designers, planners and decision-makers in their quest to create vibrant, accessible and people-centric cities of the future.

2. MATERIALS and METHODS

The literature on urban design and architecture highlights the importance of creating a built environment that is responsive to its users. This includes designing spaces that are safe, accessible and easy to navigate. The use of different construction materials can significantly impact the pedestrian experience.

For example, the use of hard surfaces such as concrete and asphalt can create a sterile and unwelcoming environment that discourages walking.

In contrast, the use of natural materials such as wood and plants can create a more inviting and comfortable environment that encourages people to walk. In this context, the aim of this study is to explore the relationship between urban space and construction materials and pedestrian traces and routes.

The study is based on a critical analysis of case studies of urban spaces in different cities around the world. The analysis considers how the use of different construction materials affects the way pedestrians move and interact with their surroundings.

The case studies include examples of successful urban spaces and the analysis focuses on identifying best practices and lessons learned. The research draws on existing literature on urban design, architecture and environmental psychology to inform the analysis.

In this study, various case studies, research findings and best practices from around the world to illustrate the transformative potential of construction materials in shaping pedestrian-friendly urban environment will be explored.

By analyzing the interplay between material selection, urban design and the pedestrian experience, it is aimed to provide insights and recommendations that can guide future urban development endeavors and foster the creation of more livable and sustainable cities.



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The Role of Construction Materials in Urban Environment

Urban space is a dynamic and constantly evolving concept that is shaped and influenced by a range of factors, including the choice of construction material used to build it, the pedestrian traces left behind by its inhabitants and the routes taken by people as they move through it.

Communication, coexistence, co-production, socialization, etc., which are one of the basic features of urban life. It also brings with it interactions. "Private" and "public" experiences interact with each other both directly and indirectly through their unique lifestyles and uses of space. In this context, squares and streets, which are the most important elements of the public space, are the most important components of the relationship established with the private (Biçer Özkun, 2017). As spaces where citizens get together and carry out leisure activities, public spaces are among the most important elements of a city. Streets are public spaces that provide for people's transportation needs as well as being places for socialization and sharing. Streets also offer essential facilities to citizens with their visual richness and aesthetics. Streets are public spaces that serve citizens as important elements of the urban image. As public spaces, streets can be distinct from other spaces or have an identity with the agglomeration of similar functions and/or structures from different or similar architectural periods (Ergen, 2013).

In the bustling and dynamic urban landscape, the concept of creating pedestrian-friendly environments has gained significant attention in recent years. As cities continue to grow and evolve, the need to prioritize the well-being and mobility of pedestrians has become a crucial aspect of urban planning and design. Central to this endeavor is the understanding that the selection of construction materials plays a fundamental role in shaping the urban realm and influencing the overall pedestrian experience.

Walking through a city is a multisensory experience that encompasses not only the visual aesthetics but also the tactile qualities and acoustic properties of the built environment. The choice of construction materials, such as paving stones, concrete, wood, or recycled materials, can significantly influence the way pedestrians interact with their surroundings. These materials can shape the comfort, safety and overall ambiance of streets, sidewalks and public spaces, ultimately affecting the quality of life and well-being of urban dwellers.

Moreover, construction materials play a crucial role in addressing environmental sustainability and resilience challenges in urban settings. The use of eco-friendly and locally sourced materials can reduce the carbon footprint associated with construction activities, promote resource efficiency and contribute to the overall environmental performance of cities. Additionally, the selection of materials with enhanced durability and resistance to wear and tear can help create long-lasting urban spaces that withstand the test of time and contribute to the sustainable development of our cities.

It is also essential to consider the social dimension as well. The choice of materials can communicate cultural identity, enhance a sense of place and foster a connection between individuals and their urban surroundings. By carefully selecting materials that resonate with the local context and reflect the aspirations of the community, urban designers and planners can create inclusive and culturally rich environments that promote social interaction and a sense of belonging among pedestrians.

In conclusion, the development of pedestrian-friendly urban environments relies heavily on the thoughtful selection of construction materials. From ensuring safety and comfort to creating



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aesthetic appeal, fostering sustainability, promoting social interaction and embracing technological advancements, construction materials play a multifaceted role in shaping the urban realm. By recognizing the transformative potential of materials, urban designers, planners and decision-makers can create vibrant, accessible and people-centric cities that prioritize the well-being and mobility of pedestrians.

The Careful Use of Construction Materials in Urban Environment

The careful use of construction materials can improve pedestrian movement and contribute to the creation of a more walkable, vibrant and sustainable urban environment. The use of different construction materials can significantly impact the pedestrian experience. For example, the use of natural materials such as wood and plants can create a more inviting and comfortable environment that encourages people to walk. The use of hard surfaces such as concrete and asphalt can create a sterile and unwelcoming environment that discourages walking.

In addition, concrete is often used for large-scale infrastructure projects, like highways and bridges. Its smooth surface allows for easy movement of vehicles while also serving as a durable surface for pedestrians. However, the starkness of this material can also contribute to a lack of warmth and character in the urban environment. Asphalt, meanwhile, is commonly used for roads and sidewalks. Its dark color can absorb heat and make urban areas feel hotter, but it is also relatively inexpensive and easy to maintain. Its smooth surface provides a relatively even terrain for pedestrians. Brick and terrazzo, on the other hand, offer a more tactile experience. These materials provide a textured surface that can be more comfortable for walking, but can also become uneven and potentially hazardous if not properly maintained. They also lend a warmer, more human-scale feel to public spaces, which can encourage people to linger and socialize in these areas.

Designers should consider the impact of different materials on the pedestrian experience when designing urban spaces.

Enhancing Safety and Comfort

The selection of construction materials significantly impacts the safety and comfort of pedestrians in urban environments. For instance, the choice of non-slippery, well-maintained paving materials can reduce the risk of accidents and falls, ensuring a safer walking experience. The use of materials with shock-absorption properties, such as rubberized surfaces or innovative pavement designs, can enhance walking comfort, reducing fatigue and minimizing the impact on joints. By prioritizing pedestrian safety and comfort through the thoughtful selection of construction materials, cities can create inclusive and accessible environments that encourage active modes of transportation.

Creating Aesthetic Appeal and Identity

Construction materials are instrumental in creating the aesthetic appeal and identity of urban spaces. The careful selection of materials that harmonize with the architectural style and cultural heritage of a city can evoke a sense of place and strengthen the visual character. For example, the use of locally sourced materials, such as natural stone or timber, can celebrate the region's unique identity and create a distinct sense of authenticity. Integrating artistic and innovative materials, such as decorative tiles or sustainable murals, can infuse urban spaces with creativity and invite pedestrians to engage with their surroundings on a deeper level.



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Fostering Sustainability and Resilience

In an era of increasing environmental consciousness, the role of construction materials in promoting sustainability and resilience cannot be overstated. The choice of eco-friendly materials, including recycled or reclaimed materials, can significantly reduce the carbon footprint associated with construction activities. Additionally, the use of permeable paving materials allows for natural water infiltration, mitigating stormwater runoff and contributing to urban water management. By adopting materials that are durable, low-maintenance and energy-efficient, cities can reduce the environmental impact of their infrastructure while creating resilient and long-lasting pedestrian-friendly urban environments.

Influencing Social Interaction and Engagement

Construction materials have the potential to influence social interaction and engagement among pedestrians. The design and selection of materials can encourage people to gather, linger and interact within public spaces. For instance, incorporating seating elements made from sustainable materials or using art installations as focal points can create opportunities for socializing and community building. By choosing materials that invite touch, such as textured surfaces or interactive elements, cities can foster a deeper connection between individuals and their urban environment, promoting a sense of ownership and pride.

Embracing Technological Advancements

The rapid advancement of technology offers new opportunities for the role of construction materials in shaping pedestrian-friendly urban environments. For example, the integration of smart materials, such as self-healing concrete or photovoltaic pavement, can enhance functionality and sustainability. These materials can detect and repair cracks autonomously or generate renewable energy, contributing to the overall efficiency and resilience of urban spaces. By embracing technological advancements in construction materials, cities can create innovative and future-ready environments that adapt to the changing needs of pedestrians.

The Examples of Careful Use of Construction Materials in Urban Environment

The selection of construction materials plays a vital role in shaping the pedestrian-friendly urban environment. High-quality materials that are visually appealing, durable, slip-resistant and comfortable to walk on contribute to the overall experience of pedestrians and promote a sense of safety and livability in cities. The examples below demonstrate how the selection and integration of construction materials in street and pedestrian way designs can significantly contribute to shaping pedestrian-friendly urban environments.

Barcelona's Passeig de Gracia

The wide sidewalks of Passeig de Gracia in Barcelona are paved with high-quality materials such as granite or natural stone. These materials not only provide a visually appealing ambiance but also offer a durable and slip-resistant surface for pedestrians. The careful selection of materials enhances the pedestrian experience and promotes walkability (Figure 1).



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Figure 1. Barcelona's Passeig de Gracia

Reference 1a: URL 1
 Reference 1b: URL 2
 Reference 1c: URL 3

Reference 1d: URL 4
 Reference 1e: URL 5
 Reference 1f: URL 6

Reference 1g: URL 6

Tokyo's Takeshita Street

Takeshita Street in Tokyo's Harajuku district is a popular pedestrian area. The street is lined with a mix of colorful and vibrant materials, including decorative tiles and patterned concrete. These materials contribute to the unique charm of the street, creating an energetic and engaging atmosphere for pedestrians (Figure 2).



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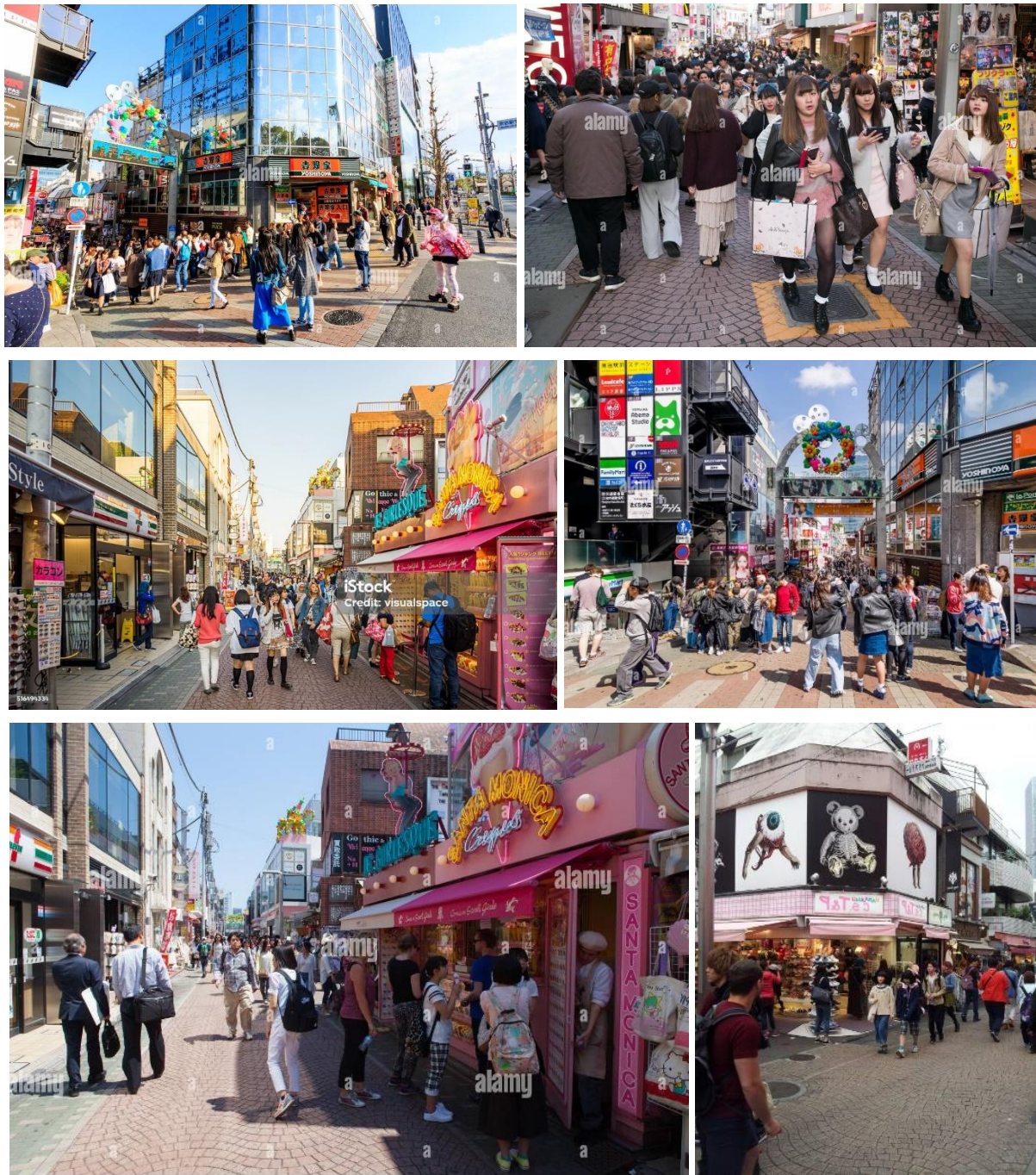


Figure 2. Tokyo's Takeshita Street

Reference 2a: URL 7
 Reference 2b: URL 8

Reference 2c: URL 9
 Reference 2d: URL 10

Reference 2e: URL 11
 Reference 2f: URL 12

Copenhagen's Strøget

Strøget, one of Europe's longest pedestrian streets, is a prime example of how construction materials can shape a pedestrian-friendly urban environment. The street is paved with high-



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quality materials such as granite, cobblestones and bricks. These materials not only provide a visually pleasing aesthetic but also help reduce noise and create a comfortable walking surface (Figure 3).



Figure 3. Copenhagen's Strøget

Reference 3a: URL 13
Reference 3b: URL 14

Reference 3c: URL 15
Reference 3d: URL 16

Reference 3e: URL 17
Reference 3f: URL 18

New York City's High Line

The High Line, a linear park built on a former elevated railway track, utilizes a combination of materials to create a pedestrian-friendly experience. The pathway is paved with a mix of concrete, wood and steel, reflecting the industrial heritage of the site. These materials blend harmoniously with the surrounding urban context while providing durability and an inviting atmosphere for pedestrians (Figure 4).



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Figure 4. New York City's High Line

Reference 4a: URL 19, Reference 4b: URL 20, Reference 4c: URL 21, Reference 4d: URL 22, Reference 4e: URL 23, Reference 4f: URL 24)

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Seoul's Cheonggyecheon Stream

Cheonggyecheon Stream is an urban renewal project in Seoul that transformed an elevated highway into a pedestrian-friendly waterway. The stream is lined with various construction materials, including natural stones, concrete and steel, which provide a visually appealing and durable surface for pedestrians to walk along. The integration of bridges, seating areas and art installations further enhances the pedestrian experience, creating a serene and engaging environment amidst the bustling city (Figure 5).



Figure 5. Seoul's Cheonggyecheon Stream (Reference 5a: URL 25, Reference 5b: URL 26, Reference 5c: URL 27, Reference 5d: URL 28, Reference 5e: URL 29, Reference 5f: URL 30)

4. CONCLUSION and RECOMMENDATIONS

The role of construction materials in shaping pedestrian-friendly urban environments is undeniably significant, extending far beyond their functional properties. Through careful selection and innovative design, these materials have the power to transform cities into vibrant, accessible and engaging spaces for pedestrians.

First and foremost, construction materials play a pivotal role in enhancing safety and comfort for pedestrians. By choosing non-slippery, shock-absorbing and well-maintained materials,



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cities can create environments that minimize the risk of accidents and reduce fatigue, encouraging more people to walk and engage in active modes of transportation. A safe and comfortable urban environment is not only beneficial for individuals but also contributes to the overall livability and vitality of a city.

Furthermore, construction materials contribute to the aesthetic appeal and identity of urban spaces. By selecting materials that reflect the cultural heritage and architectural style of a city, designers and planners can create environments that evoke a sense of place and pride. The integration of locally sourced materials and the incorporation of artistic elements add depth and authenticity to urban spaces, inviting pedestrians to connect with their surroundings on a deeper level.

In the pursuit of sustainability and resilience, construction materials offer immense potential. The use of eco-friendly and locally sourced materials reduces the environmental impact of construction activities and promotes resource efficiency. Additionally, the adoption of durable and low-maintenance materials ensures the longevity of urban spaces, contributing to the sustainable development of cities. As humanity faces the challenges of climate change and urbanization, the selection of resilient materials becomes crucial in creating urban environments that can withstand the test of time and adapt to evolving needs.

Moreover, construction materials have the power to influence social interaction and engagement. By incorporating materials and designs that encourage gathering, seating and interaction, cities can foster a sense of community and belonging among pedestrians. The tactile qualities of materials, combined with interactive elements, invite people to engage and explore their urban environment, promoting social cohesion and a sense of ownership.

Lastly, the rapid advancement of technology opens up new possibilities for the role of construction materials in shaping pedestrian-friendly urban environments. The integration of smart materials, with their self-healing capabilities, energy generation potential and data-driven functionalities, can revolutionize the way of design and experience in the cities. Embracing these technological advancements allows to creation of innovative and future-ready urban spaces that adapt to changing needs and provide sustainable solutions.

In conclusion, the role of construction materials in shaping pedestrian-friendly urban environments is multifaceted and transformative. By harnessing their potential, cities can create inclusive, sustainable and people-centric environments that prioritize the well-being and mobility of pedestrians. By embracing the power of construction materials and integrating them into holistic urban planning approaches, the cities that are not only functional and efficient but also beautiful, resilient and responsive to the needs and aspirations of their inhabitants can be built.

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DECAY AS A FIELD OF FORMLESSNESS IN ARCHITECTURE

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ABSTRACT

Georg Simmel perceives ruins as nature's triumph over human-made artifacts, symbolizing the collapse of tools and institutions through which humanity has sought to capture and regulate life. As time erodes matter, it concurrently dismantles the illusion of a stable form. If architecture is acknowledged as a cultural construction, driven by the pursuit of stability and permanence, as suggested by Georges Bataille, decay not only deforms the physical manifestation of architecture, but also challenges the epistemological constructs the discipline serves. Decomposition undermines rigidity, rules, and predictions, revealing the formless concealed within architectural form. Thus, formlessness, brought forth by decay, emerges as a critical field, parallel to the role Bataille assigns to the concept of "informe (formless)". Within this framework, this study aims to explore architectural decay, discussing the subject by alluding to Albert Speer's concept of "ruinenwert (ruinvalue)" and Bernard Tschumi's argument that architecture harbors its own decay as it encompasses both prescriptive aspect of design and experiential aspect of use. Thus, the paper endeavors to examine ruination as the emergence of formlessness within architectural form, thereby to discuss decay as a challenge to the inherent intentions within the field of architecture.

Keywords: Formlessness, Architectural Form, Architectural Decay, Bataille, Simmel, Tschumi.

1. INTRODUCTION

Interest in architectural decay has been steadily growing in the 21st century. While the fascination with ruins has been relevant since the advent of archaeology, the epistemological and semantic aspects of decay have predominantly gained attention over the past two centuries. One of the most significant contributions to the semantics of decay can be found in Georg Simmel's definition. In his article titled "Die Ruine", Simmel (1911) perceives decay as the consequence of the ongoing battle between human-made forms and nature. For Simmel, ruination is not only the formlessness of matter but also the triumph of nature's inherent form over humanity's creations. Consequently, the ruin becomes an expression of humanity's defeat against nature, or rather, the collapse of the tools and institutions through which civilizations seek to organize life.

Thus, by shattering the illusion of humanity's ability to structure and design the world, decay dismantles the illusion of a stable form, rendering all constructions formless. Therefore, decay



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does not merely deteriorate matter, but also the epistemological constructs, including those of architecture, by introducing the formless.

Within this perspective, this study aims to explore architectural decay while examining ruination as the emergence of formlessness within architectural form. In doing so, it seeks to discuss decay as a challenge to the inherent intentions within the field of architecture.

2. The Concept of Formlessness

As the intended investigation necessitates a revisit to the definitions of "form" and "formless", the study anticipates the concepts as interpreted by Georg Simmel and Georges Bataille, respectively.

Simmel (1918) asserts when life transcends the realm of biological existence to enter the mental realm, it produces specific artefacts, or forms. Spontaneous life, to some extent, requires these forms to exist as an entity, since life, being inherently formless, "can only manifest itself as a phenomenon by being given form" (Simmel, 1918). However, cultural constructions (or forms), generated within the flow of life, solidify, become independent, and attempt to impose order onto the variable, unpredictable and flexible flow of life itself, thereby entering into an opposition with it. Simmel (1918), therefore, identifies a conflict between life and the forms it produces when he argues that form is the opposite of life.

Bataille (1929b) assigns a similar role to forms when he asserts the world is inherently formless, while all social constructions attempt to impose a form, or give "a mathematical frock-coat" onto the world. He writes:

"In fact, for academic men to be happy, the universe would have to take shape. All of philosophy has no other goal: it is a matter of giving a frock coat to what is, a mathematical frock coat." (Bataille, 1929b).

By his definition, Bataille further assigns a critical role to the concept of "formless (*informe*)", in opposition to the "architectural order" that imposes a structure onto the universe. According to this interpretation, architecture, emerging as a potent form for organizing and framing life, not only reflects social constructs but also serves as the initiator and sustainer of cultural institutions. In his brief text "Architecture", Bataille (1929a) explains how architecture operates as a vehicle for achieving absolute social consensus by purging the environment of its differences to regulate life. Indeed, the chaotic and formless aspects of the world are eliminated through architectural practice, resulting in the stabilization and organization of the environment.

However, as demonstrated by Simmel, architecture, as a cultural construct, contradicts the dynamics of life- its transience, variability, and diversity. This perspective emerges from his theory of a conflict between life and forms. Simmel writes:

"With each and every new form of existence which it creates for itself, its perpetual dynamism comes into conflict with the permanence or timeless validity of that form. Sooner or later the forces of life erode every cultural form which they have produced." (Simmel, 1918).

Decay emerges as a natural force of spontaneous life that erodes architecture, thereby revealing the formless and challenging the narratives edifices have been carrying. In this regard, ruins demonstrate the inevitable conflict between the perpetual dynamism of life and the impulse of architectural forms to remain fixed and eternal.



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3. Ruins, as the Antitheses of Monuments

While ruins have occasionally been romanticized as aesthetic objects throughout history, they serve as poignant reminders of the collapse of the forms and institutions through which humanity has organized the chaotic world. Therefore, it is unsurprising to witness various efforts aimed at restoring them to their former glory, in an attempt to preserve the permanence of these forms. Walter Benjamin's apprehension of Paul Klee's painting "*Angelus Novus*" aptly illustrates how humanity endeavors to restore these forms to their initial state. Benjamin writes:

"This is how one pictures the angel of history. His face is turned toward the past. ..., he sees one single catastrophe which keeps piling wreckage upon wreckage and hurls it in front of his feet. The angel would like to stay, awaken the dead, and make whole what has been smashed. ... This storm irresistibly propels him into the future to which his back is turned, ... This storm is what we call progress" (Benjamin, 1940).

The *Angelus Novus*, or the "Angel of History" as designated by Benjamin, demonstrates how the passage of time transforms matter into ruins. While the Angel of History attempts to recuperate these ruins, the winds of progress, or the relentless passage of time, compel him to leave them behind to proceed towards the future.

DeSilvey & Edensor (2013) refer to ruins as "counter-sites", highlighting their potential to undermine and critique manifestations of power. Furthermore, decay liberates forms from their initial ideals, allowing them to be perceived anew by modern beholders who infuse them with novel meanings. This perspective aligns with Alois Riegl's notion of "age value". In his "*The Modern Cult of Monuments*", Riegl (1903) defines "age value" in opposition to the "historical" and "commemorative values" assigned to monuments. Age value emerges from the natural decay that artworks bear, rendering the passage of time visible. While commemorative value is dictated by the deliberate intentions of a monument's creators in its original form, age value is conferred by the modern viewer. Consequently, age value arises when the passage of time distorts the values and meanings associated with the artwork, illustrating that natural forces not only alter the monument itself but also the very intentions and narratives it carries. Riegl (1903) also notes how the conservation processes counter age value. In this vein, Allais (2013) characterizes conservators as "formless keepers" who seek to restore the form to its initial state to control the viewer's experience with the architectural object.

Albert Speer, however, introduces an alternative approach to "formless keeping"—one that does not entail restoration but rather the deliberate design of the passage of time. Speer developed the concept of "*ruinenwert* (ruinvalue)", an idea also embraced by Hitler, in the 1930s. This concept entails designing a building "to appear aesthetically pleasing even in a state of ruin" (Speer, 1970), with the intention of creating a "bridge of tradition" for future generations. In this context, the complete collapse of a structure was undesirable. Instead, through careful structural calculations and material choices, it was envisioned that even centuries or millennia later, a building could become a ruin yet still reflect the "grandeur" of its era, akin to Roman ruins embodying the "splendor" of their time (Speer, 1970) (Figure 1).



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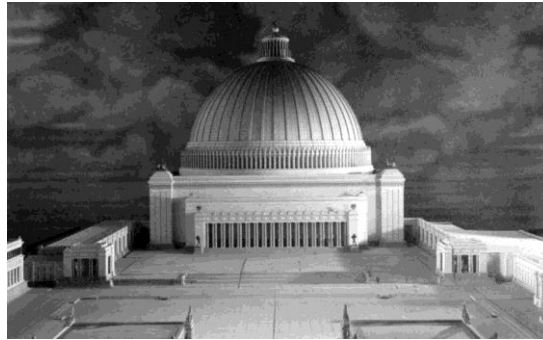


Figure 1. Speer, *Große Halle* (Great Hall), model, 1939 (Bundesarchiv, Bild 146-1986-029-02 / CC-BY-SA 3.0).

Clearly, Speer's concept of "ruinvalue" encompasses more than simply allowing nature to reclaim structures and relinquishing control over them (Stead, 2003). Ultimately, material selection and construction technique facilitate controlled decay. This control over the future ensures that, even as the form crumbles, its ideals remain intact. Designing the moment of decay becomes crucial for the continuation of the form, as incorporating deformation into the construction is essential to prevent the dissolution of stability. As in the case of Roman or ancient Greek monuments, when a ruin transforms into an aesthetic object, it ceases to function as an artifact that is capable of challenging humanity's assumption of rational progress (Trigg, 2006), so it no longer is an object that reveals the fragility and potential deformation of the world structures.

Architecture, in fact, can stabilize its own form to the extent that it overcomes the nullifying power of ruins through the maintenance of monuments. Consequently, one could argue that ruin is the ultimate antithesis of monument (Stead, 2003).

4. Decay as an Inherent Aspect of Architecture: the Perspective of Tschumi

In this case, the term "ruin value" can be regarded as architecture's assimilation of its opposite by incorporating it into its essence, given that ruins contradict monuments. Tschumi (1976), however, to the contrary, asserts that architecture inherently harbors actions and phenomena that undermine and disrupt its established conventions, leading to its dissolution. Hence, decay is a domain already encompassed by architecture. Tschumi (1976) elucidates how the moment of decay is immanent within the structure itself, manifesting through its use and experiential aspects. According to his theory, decay indicates the point where the "spatial praxis meets mental constructions" (Tschumi, 1976). He designates "transgression" as the point where architecture negates its own conventions. The building, through its physical existence, entails or even induces actions that will lead to its deterioration. Within this context, while one could argue that these actions and phenomena might indeed be considered integral to the building, the question remains: are they truly a part of architecture?

The dilapidated state of Villa Savoye (1928) during the post-war era provides an illuminating case for discussing this question. In the opening section of Tschumi's article "Architecture and Transgression", he presents a poster featuring a photograph from the series "Advertisements for Architecture (1975)", depicting the derelict condition of Villa Savoye in 1965 (Figure 2). In the poster, he claims that the "most architectural thing" concerning the structure is its condition

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of deformation (Tschumi, 1976). Beneath the image depicting the abandoned residence, the following inscription is found:

“Architecture only survives where it negates the form that society expects of it. Where it negates itself by transgressing the limits that history has set for it.” (Tschumi, 1976).

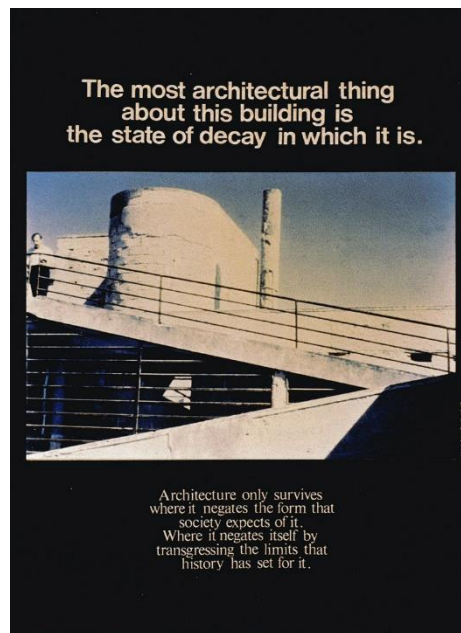


Figure 2. Tschumi, advertisements for architecture (1975) (Tschumi, 1976).

Villa Savoye, a symbol of modern architecture's residential ideals, had transformed into a state of dereliction during the 1950s (Figure 3). Madame Savoye was compelled to vacate her residence in 1940 due to the occupation of France by Nazi Germany. Upon her return after the war, she resided in the house for a period; however, due to the technical and functional predicaments the house harbored, she once again abandoned it. Describing the state of the residence during the 1960s, Blake (1960) characterizes it as "a strange and rather tragic ruin", offering the following depiction:

"What remains of the Villa Savoye today is, ...: a streaky, grey, rectangular box of reinforced concrete, under this concrete box, ..., there is now a hideously ugly pile of junk that looks, more or less, like the local village dump."

Upstairs, inside the great concrete box, ...; most of the windows are boarded up; much of the floor area serves as a hayloft. Most of the paint has flaked off the walls; white splotches of plaster have appeared next to the original pastel blue. The patio, in the centre of this upper floor, is part hayloft, part weed garden.

Finally, the roof structure, this is a composition of straight and curved concrete screens and forms, now as pale and flat and desolate as the rest –flaking paint, streaked concrete, rusty railings, weeds everywhere." (Blake, 1960).



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Figure 3. Villa Savoye in 1959, (photo: Rene Burri, 1959) (Source: Archiwik).

Blake's description illustrates how the Modern Architecture's timeless, abstract, hygienic, pure and geometrically universal form has transformed into a ruined structure filled with debris. The decayed state of Villa Savoye fundamentally undermines the taboos of modernism, primarily because Modern Architecture typically renders time imperceptible and anticipates the perpetual endurance of forms, while Villa Savoye has manifested the passage of time through its deformation (Jormakka, 2005). Furthermore, designed with a functionalist and rationalist ethos, the residence ironically had issues regarding function and construction, contributing to its abandonment (Jormakka, 2005). In a sense, as Tschumi's statement suggests, it negated "the form that society expects of it" (Jormakka, 2005). As the quintessential embodiment of modern design, this dwelling exposes its state of decay as an embodiment of the deterioration of Modern Architecture's all utopian aspirations and ideals. It stands as a testament to the dismantling of the form that Modern Architecture sought to impose, ultimately evolving into formlessness.

On the other hand, Tschumi (1976) highlights another aspect within the state of decay, which is the relevance of architecture's capacity to concurrently encompass the state of excess (i.e., its decay) in both rational and sensuous aspects. In another poster from the "Advertisements for Architecture" series, he presents a photograph of the interior space of the ruined Villa Savoye and inscribes that when architecture is taken to the excess, it will simultaneously "reveal both the traces of reason and the sensual experience of space" (Tschumi, 1976).

What fascinates Tschumi (1976) about Villa Savoye is the coexistence of logic and sense within the same space, which he perceives as an "architectural condition". The state of decay, viewed by Tschumi as integral to architecture itself, unveils the formless concealed within form, thereby revealing the extraordinary within the ordinary. Thus, decay becomes an act of surreal existence. Indeed, Blake (1960) characterizes Villa Savoye's decayed state as a "lovely, surrealist dream existence", describing it as "a delightful ruin".

In this context, decay becomes a tool for unlocking the potential concealed within architecture while simultaneously opening the building to viewers to infuse it with new meanings. Then, one may argue that decomposition possesses the capacity to reconcile two distinct historical paradigms. One is the aspect lived and experienced by modern observers, while the other is the notion documented and propounded by historians (Allais, 2013).



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Thus, akin to the concept of age value coined by Riegl, deformed structures that bear the marks of the passage of time, are more amenable to receiving new meanings rather than imposing the narratives of their creators and era. This transformation is not solely attributed to the passage of time or the forces of nature, but is also induced by the actions of users. Consequently, this is the point at which Tschumi's assertion gains credibility, since the building inherently encompasses its own formlessness, considering that both usage and time, each in its own right, contribute to decay.

Nevertheless, while Tschumi perceives this moment of decay as an integral aspect within architectural design and even contends that the act of decaying is the "most architectural thing" within it, one may argue that the moment of decay is, in fact, the juncture at which the building diverges most decisively from architectural practice itself. It is precisely for this reason that Speer, by integrating the moment of departure from architecture into the building's structure, seeks to incorporate decay as an element of the structure and, consequently, a constituent of its form. For the decay of the building, both physically and symbolically, its deformation, is akin to a strike on its initial form. In this case, the deformation and decay within the flow of life might indeed correspond, contrary to Tschumi's assertion, to "everything non-architectural" and remain "outside" the realm of architecture. It shatters all rigidity, all rules, all predictions of the architectural construct. Architecture cannot encompass it, thus demonstrating that this challenge can only exist outside the sphere of architectural practice.

Perhaps the issue lies not solely in designing spaces that enable various experiences to coexist within a form; perhaps the crux of the matter lies in life's struggle against form, as identified by Simmel, and the actualization of the virtualities embedded within the existing structure.

5. CONCLUSION

In this exploration of architectural decay, ruination has been elucidated as the emergence of formlessness within the framework of architectural form, thereby posing a challenge to the intrinsic intentions of architecture, as well as the conventional apprehension of architectural object as an enduring, stable form. The study underpins its argument on the acknowledgement of the concepts "form" and "formless" as they have been expounded by Simmel and Bataille in the early 20th century. Simmel's insights into ruins highlight the conflict between human-made structures, or forms, and the forces of nature, unveiling how decay disrupts not only physical substance but also the epistemological constructs. If architecture is acknowledged as a cultural construction, as posited by Bataille, then decay not only challenges the physical manifestation of architecture but also the narratives it conveys. The role Bataille ascribes to the concept of formless is also pivotal in this regard, as he explicates form as a mathematical frock-coat that regulates all facets of life. He further emphasizes that architecture, as a form-creating practice, assumes a pivotal role in imposing order upon the formless world.

From this vantage point, in pursuit of stability, order, and permanence, architecture stands in stark contrast to ruins, which may be perceived as the antitheses of monuments. Therefore, architecture might only preserve its form by incorporating the destructive forces of nature, as illustrated by Speer's concept of "ruinvalue", which advocates for a controlled decay of edifices. By designing buildings that retain their aesthetic appeal even in a state of decay, Speer sought to bridge tradition across generations. This approach demonstrates a deliberate effort to govern the process of decay and maintain the form even when the edifice succumbs to the passage of time.



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On the other hand, Tschumi's perspective challenges the conventional comprehension of decay, asserting that it is an inherent facet of architecture itself, encompassing both the prescriptive aspects of design and experiential dimensions of use, thereby harboring moments of decay and formlessness. Consequently, Tschumi perceives decay as a negation of acknowledged architectural form, implying that it transgresses the historical boundaries of the discipline. However, this assertion prompts a pivotal inquiry: Does decay truly belong within the realm of architecture, or does it represent a departure from it? The ruined state of Villa Savoye during post-war era poses a compelling elucidation to this question. The dilapidated building renders all ideals of Modern Architecture futile. It renders the passage of time visible, while Modern Architecture aspires to permanence. The abandoned structure, reclaimed by nature, stands in stark contrast to the idealistic, white, hygienic geometric boxes of Modern Architecture.

Ultimately, the concept of architectural decay challenges the traditional boundaries of architecture and engenders contemplation regarding the relationship between form and formlessness. It underscores the dynamic and evolutionary nature of human-constructed structures and the enduring conflict between the yearning for permanence and the inevitability of decay. Architectural decay invites us to reevaluate the role of time, nature, and life itself in shaping the built environment and encourages a deeper exploration of the formless within the realm of architecture.

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**A DESIGN EXPERIMENT ON TEMPORARY SHELTER AFTER EARTHQUAKE:
MODULAR BASIC LIVING UNIT**

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ABSTRACT

The concept of space is a human construct, which is the sum of the boundaries created within the natural environment for a specific purpose or need. At the same time, spaces are an expression of the organization that embodies the social relationship that human life establishes with its immediate environment. Spaces, which encompass human relations and the various subcomponents of these relations during daily life and host different processes of life, are places where perceptions and experiences transform into consciousness, character and memories. Therefore, spaces are equipped with the meanings and identities that people attribute to them. However, spaces can sometimes lose their physical and existential opportunities they provide to people due to different natural disasters, especially earthquakes. This study presents temporary modular "basic living unit" proposals that offer flexible use, easy to produce and install, portable, healthy, comfortable and economical, "shelter" function-prioritized solution alternatives for disaster victims. In this context, it focuses on the design process addressed within the scope of the "Modular Systems" course of Istanbul Galata University Department of Interior Architecture and Environmental Design in the Spring semester of 2022-2023. Through the process of experimentation and the presentation of the selected final works, it opens the subject to discussion as an important design problem with the aim of consideration and diversification. Four designs selected among the projects developed by the students during the fourteen-week semester constitute the sample of the study. Thus, it was tried to create safe and meaningful living environments for the user which temporarily meets the need for shelter in a short time after the disaster.

Keywords: Modular systems, flexible design, basic living unit, adaptive space, interior architecture.

1. INTRODUCTION

"...by leaving the space of one's usual sensibilities, one enters into communication with a space that is psychically innovating."

Gaston BACHELARD (Poetics of Space: 206)

Architectural design is a phenomenon that should be handled in a holistic system from building form to spatial elements. In addition to meeting all the physical, cultural, psychological and even aesthetic needs of the user, the adaptation of the design to different conditions has become one of the most important parameters expected from an architectural design, especially today.



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The dictionary definition of adaptation is "the action or process of changing something, or of being changed, to suit a new purpose or situation" (Oxford Learner's Dictionary, 2023). In 2020, the pandemic that affected the whole world has already reminded the importance of such spaces. Various design solutions have been developed on flexibility in spaces that need to transform to be used for many functions at the same time or at different times of the day (Turgay, 2022). Similarly, the earthquake disaster, which poses a very serious danger for Turkey, has once again underlined the concepts of adaptation and flexibility in design, especially for the post-disaster period.

The vibrations caused by the fractures under the earth's crust are called "earthquakes" when they spread as waves and shake the earth and the environments they pass through (Atabey, 2000). Considering the geographical structure of Turkey, it is known that Turkey is located in a very active earthquake zone and has experienced many earthquakes in its history. 95% of the population of our country is at risk of earthquakes, the majority of the population is located in earthquake zones, unplanned construction, and the society does not have sufficient awareness and knowledge about earthquakes cause the loss of life and property to reach great dimensions in earthquakes (AKUT, 2008). As the possibility of similar earthquakes in the future is predicted by scientists, human beings will be inadequate in combating such natural disasters unless the necessary awareness and rational solutions are realized.

Many of the places where people realize their most basic need, shelter, have the possibility of being partially or completely destroyed due to earthquakes caused by the continuous movement of tectonic plates due to the physical structure of the earth, inappropriate spatial structures and interior space constructions (Doğan, 2020). During the Kahramanmaraş Earthquake in our country, in which thousands of people lost their lives, unfortunately, many of our citizens' houses collapsed or were damaged. As in the aftermath of previous major earthquakes, creating habitable spaces for the many people left homeless by the disaster is a problematic of great importance for the discipline of architecture. Various answers have begun to be sought for temporary housing solutions that are suitable for single individuals, crowded families, married couples or nuclear families, suitable for all seasonal conditions, where daily activities can be easily carried out, which provide storage and can be produced quickly.

There are many examples of post-earthquake temporary housing around the world. The common points of these designs, in which housing, educational and religious building functions are the majority, are lightweight materials, mostly prefabricated, dismountable when necessary, fast and easy to produce, easy to transport and install (Halıcı, 2023; DAC, 2023). In addition to these, the building should be organized spatially correctly and should be able to meet the physical, psychological, hygienic, personal, social and aesthetic needs of the user (Beyatlı, 2010). Furthermore, since the post-earthquake period will be characterized by the creation of a living space consisting of many units rather than a single living unit, how the units will come together and what kind of texture they will form is as important as designing the unit itself.

The design question that emerged at this point, briefly defined as "creating relatively "comfortable" living units that can be reproduced as needed in a short period of time for users with different populations and different lifestyles", was the subject of the Modular Systems Course at Istanbul Galata University, Department of Interior Architecture and Environmental Design, in the spring semester of 2022-2023. Under the title "Modular basic living unit", the students designed flexible living spaces supported by movable elements by creating a module



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that can be multiplied and diversified. This study aims to emphasize the importance of the concepts of modularity, adaptability and flexibility in spatial design by presenting the projects created within the scope of the aforementioned course to the literature. It is thought that the resulting basic living units can form the basis for many different contexts such as minimal living spaces, nomadic life, or even sustainable living spaces, especially the temporary shelter units after the earthquake we are currently in.

Module and Modular Systems

As a human construction, space is a fiction that is the sum of the boundaries set within the natural environment for a specific purpose or need where actions such as protection, sheltering, warming, etc. can be performed. They are expressions of the organization that embodies the social relationship that human life establishes with its immediate environment. Space, which is the equivalent of shelter, protection and refuge, which is the most basic need of human beings as a social being, is also an indicator of belonging to a class, status or class identity in the society, apart from the first functional approaches within the framework of the modern age. Therefore, the places where people live, work and socialize are determined and organized according to the dynamics of their socio-economic and socio-cultural structure.

Today, thanks to developing technology, new production methods and smart materials, it is possible to obtain higher quality, long-lasting, high-strength and economical structures. Especially with the understandings brought by industrialization, standardization in production appears as an indispensable necessity. As a requirement of standardization, the concept of "module" and understandings such as "modular coordination" have emerged. The search for harmony in aesthetic unity, which has been going on since ancient times, started with the "Golden Ratio / Golden Section" and took its current form with Le Corbusier's concept of "Modulor" based on aesthetic unity and human dimensions. Le Corbusier's concept of "Modulor" is accepted not only as a set of harmonious numbers, but also as a set of measurements that governs lengths, surfaces and volumes, bringing the human proportion to the forefront under all circumstances. it is determined and organized according to the dynamics of the structure (Tokgöz & Koçak, 2008).

The concept of module is briefly a definition of a unit. Each of the entities that make up a multiplicity is a unit or a subdivision that forms a fiction. It is a concept adopted in the production of building elements and materials in order to facilitate their assembly, minimize material consumption and provide economic benefits. The modular design approach can reduce the cost of increased variability in the production line if it results in different versions of the product by combining old and new versions of different subsystems (Mikkola, 2000). Today, it is also referred to as a dimensional value unit in order to ensure dimensional coordination in the harmonious combination of different building materials. The concept of modularity is a system created by using modules together. Modules that are similar to each other in proportion come together in a certain order and form the design. The concept of modularity in spatial design is considered as an organization system formed by the arrangement of similar elements (Pala Azsöz & Kaprol, 2022).

A standard building component is expected to fit into the overall system. Therefore, standard components of all different sizes can only be of value if they are produced in coordinated dimensions. It is therefore necessary to provide a dimensional framework for standards in the construction process, a modular coordination (Tokgöz & Koçak, 2008; Sedihemaiti & Tokman,



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2021). Modular coordination is a standardization technique that is applied in order to reach a certain standard unit of measurement of horizontal or vertical dimensions with the general coordination dimensions of the building components produced; with the building components of the various spaces and building elements in the building and allows dimensional coordination to be realized (Gökhan & Baytin, 1979). Modular coordination is very important in terms of combination details from the design stage to the application stage and the combination of different elements in a certain harmony.

2. MATERIALS and METHOD

The material of this study is selected projects created within the scope of the "İÇM 308 Modular Systems" course conducted by the authors in the spring semester of 2022-2023 at Istanbul Galata University, Department of Interior Architecture and Environmental Design. The design problem has been determined as a "basic living unit" that can emerge as an alternative solution to human living spaces or meet basic living needs in post-natural disaster processes. The unit is expected to be easy to produce, portable, installable, transportable, and constructed as a lightweight structure using different material combinations. In this context, the process consists of three stages (Figure 1).

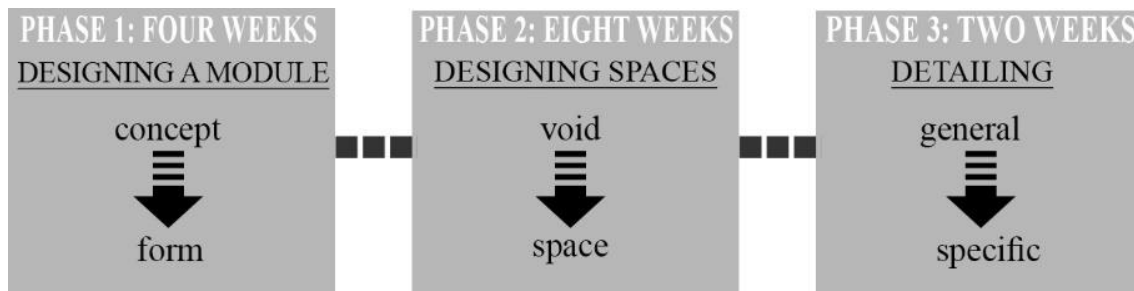
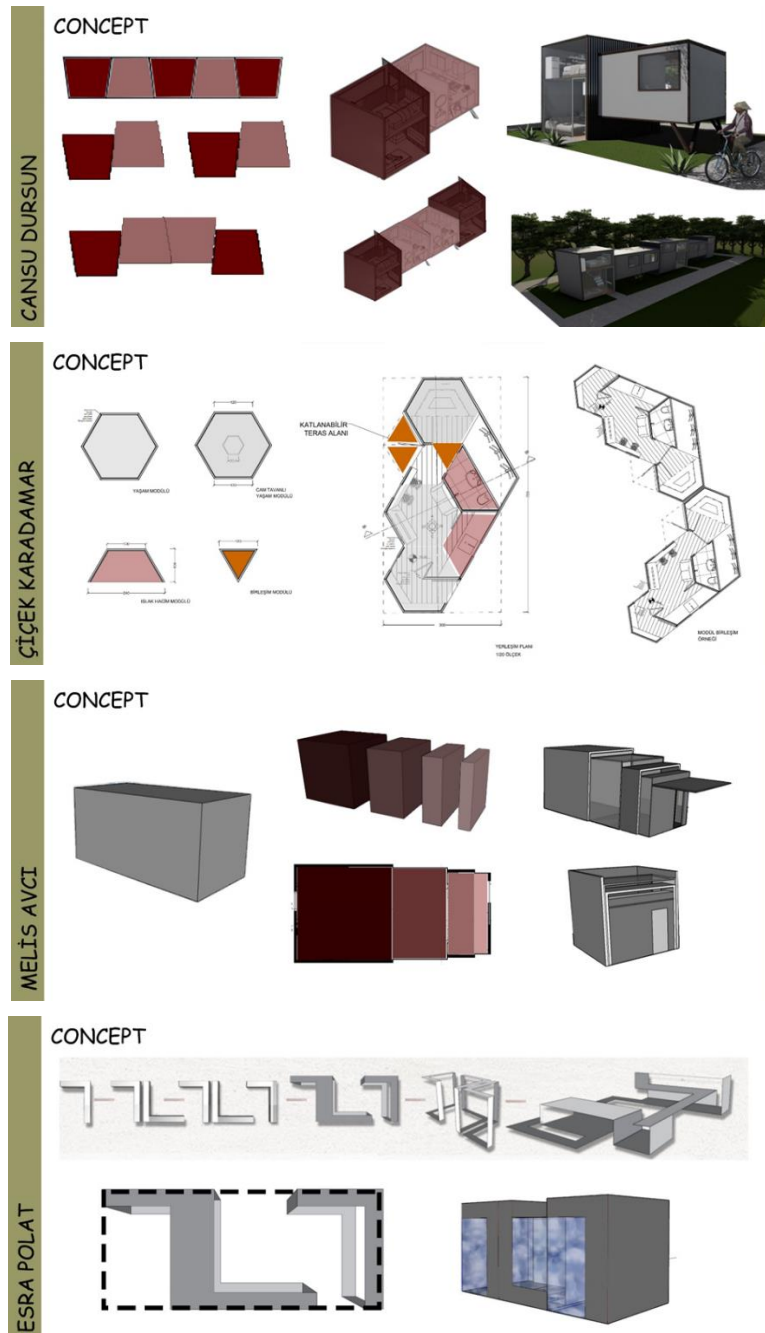


Figure 1. Stages of module design

In the first stage, students were asked to create a "unit/module" in the form of their choice, provided that they stay within the limits set as 360cm width, 720cm length and 360cm height, and to create an order within the framework of this module by using the phenomena of coordination, harmony and unity. At this point, it was emphasized that the modules should be designed as both add-removable and foldable structures that can produce flexible space solutions for different uses, diversify according to the user population and create a pattern that allows social communication when they are multiplied. In addition, attention was drawn to the lightweight structure of the form, the character of the material to be selected, and the adaptability of the unit to different topographies. While designing the three-dimensional form of the module, in addition to adhering to the inspired concept, discussions were held on the correct determination of the heights required by the users in line with their daily activities, the location of the mezzanine floor if needed and the psychological effects of the space on the user. At the end of this four-week process, the students prepared concept sheets in which they explained the form of their modules, the stages of the emergence of the module and the patterns with drawings, diagrams and graphs. The examples you will see below are the projects of students who have successfully managed the process.

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Figures 1-4. Concepts of selected projects (credit to Cansu Dursun, Çiçek Karadamar, Melis Avcı, Esra Polat)

In the second phase, which lasted eight weeks, students were asked to design spaces for living, sleeping-resting, working, storing, feeding and hygiene needs within the module. Unlike the "room" or "cell" concept in traditional housing units, these spaces were encouraged to be more flexible and permeable, with no clearly defined boundaries, such as "space within space", "space that can transform into each other" and "moving space". For the aforementioned spaces, different features such as "fixed/mobile", "transformable/transportable", "modular" were sought, especially in the surfaces, furniture and equipment that would give that space its



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function. At this stage, students were especially encouraged to research all modular systems required for a basic living unit, to examine examples and to meet with application experts. At the end of the process, the students presented the spaces they designed on the sheets they prepared with drawings, three-dimensional visuals and diagrams.

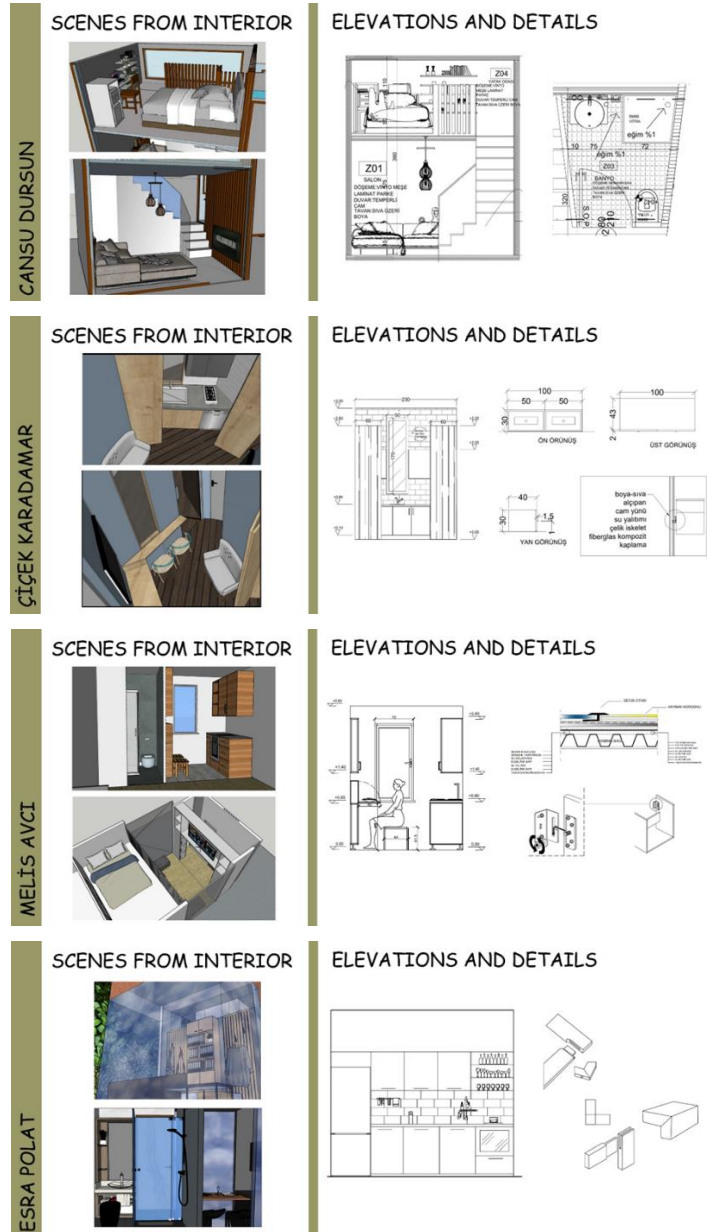


Figures 5-8. Second stage of selected projects (credit to Cansu Dursun, Çiçek Karadamar, Melis Avcı, Esra Polat)

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The third and final phase lasted two weeks. In this process, students were asked to solve the system details of the interior of the module they designed. Material selection, lighting, custom-made furniture and system details were revealed through technical drawings and graphic descriptions.



Figures 9-12. second stage of selected projects (credit to Cansu Dursun, Çiçek Karadamar, Melis Avcı, Esra Polat)

3.FINDINGS and DISCUSSIONS

When we examine the discipline of Interior Architecture in terms of education, the fact that it is both intellectual, imaginative, fictional and theoretical brings the concept of creativity, which is a situation that requires multidimensional thinking, to the forefront. Defining the design problem given in the design process well, drawing the framework clearly, developing the



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design, and ensuring that the final product is the most rational solution. As a result of the participation of technology in this process, as well as many other parameters participating in the design process, some changes are taking place in studio culture and design education. Design can also be characterized as a concept that is constantly changing, changing form, developing and transforming, as opposed to what is done by wondering, asking questions and questioning. The most important outcome of the act of design is "learning". In light of all these, design is a field where purpose-oriented, unconventional ideas are produced, discoveries are made, and in this way, the designer reveals his point of view in the face of the "situation" with the activity of "learning" as an inference.

Throughout the semester, various positive and negative points emerged within the framework of understanding the design problem correctly and in detail, defining the user profile and related requirements, and realizing technical details and drawings in line with a concept to be selected.

The biggest achievement of the students in this process is to comprehend the importance and convenience of modulation in design. In particular, they have seen the difference between standardization and custom construction in order to produce rational designs that are far from being random, to make faster, easier and more economical designs, and they have faced the existence of problems such as ensuring coordination between different elements, materials and even equipment of the building. Spatially, they tried to think in terms of flexibility and transformation instead of rigidity. Again, instead of a singular, abstract design approach, they searched for a design with features such as multiplication, articulation and adaptation by coming together and thus developed their design perspectives.

The act of designing is usually realized through a "source of inspiration", often accompanied by an intense fictional process. While the design envisioned in the mind is transformed into a final product and comes into existence concretely, what is revealed is not only what is in the designer's creativity, but also the reflections of the source of inspiration, which is the starting point of the design. In this direction, many of the students were confused about where to start when it came to creating a "unit/module", which is the first action of the design problem. There were only a few who were able to come up with bold approaches to reaching the form and the source of inspiration. There was also the difficulty of structurally constructing the module and creating different variations of this module, and establishing a coordination between them. The students, who generally gravitated towards more defined geometries such as squares, rectangles and hexagons, were still not clear about creating a system for a long time, even though they dealt with more defined geometries. In addition, many of the students who imagined non-Euclidean forms lost their mastery of the geometries they wanted to obtain by adding-subtracting or deconstructing from basic shapes.

Another problem encountered by the students was in spatial solutions; the concept of flexible space, which offers approaches that are rational, elaborate and can be transformed into different functions, was not fully grasped. Rather, conventional spatial solutions were considered and potentials were not questioned much. Spatial flexibility and adaptation were considered by many students only within the limits of movable furniture, and the alternatives for planar, linear and point elements that will form the flexible space were not sufficiently examined. Besides, students did not make enough progress in the use of lightweight materials and in producing solutions that provide easy and fast production and assembly.



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In today's design education and professional environments where design is practiced, two-dimensional drawings and models, which are traditional means of expression, have been replaced by various modelling programs that can be navigated in three dimensions, making it possible to experience design in a more interactive way. The most obvious advantages of computer use in terms of design education can be listed as easy production, saving time, increasing creativity with the help of various programs, representing design knowledge in different ways, and developing more systematic approaches in the design process. On the other hand, computer-aided designs begin to resemble each other both functionally and aesthetically due to the fact that the furniture and equipment blocks in these programs are identical. For this reason, it was observed that the students who skipped the sketching stage and worked with straightforward computer drawing had more of the above-mentioned faltering.

The projects presented in this study and the approaches that have successfully completed this process, contrary to the solutions that have not been captured by other studies above, have emphasized ergonomic and anthropometric points by questioning all these issues. In these examples, spatial adaptation has been taken out of the boundaries of furniture and equipment and addressed with its dimensional, topographical and organizational dimensions. In addition, the designs were considered together with technical features such as ease of assembly and material selection. These students endeavoured to find form through traditional sketching methods before the computer-aided design process, and managed both technical drawing and three-dimensional expression techniques well in the process of expressing the design.

3. CONCLUSION

The aim of design studios is to reveal creativity, to develop the ability of the mind, eye and hand to work together, to create design solutions by assimilating the formal, spatial and structural information obtained from other courses during the academic year. The design studio is a structure that is enriched by discussions and interactions in which all kinds of information enters at any time and does not remain as it enters, but changes with the previous experiences of the designer, the way of thinking, the way of looking at events. Another of the main objectives of studio education is to examine and structure the relationships between design, imagination and concept. The interaction between the more experienced academician and the student constitutes the basis of studio education. What happens in the studio is not a design process under the control of a single person, but the organization of a collaborative process involving mutual interaction. At this stage, transforming a simple "idea" into space and integrating it into a simple tectonic language is one of the most difficult steps in an often complex process.

Considering design as physical, intellectual and temporal reminds us that the parameters that make up design are related to perception and sensation as much as they are related to a context; that space is imagined, constructed and built. A designer's inclusion of people's perceptions, expectations and comments in the design process, in addition to observing the behavior of users and evaluating the demands, will provide a serious infrastructure and remind us that design is for people. Students who do not acquire this awareness are likely to offer spaces that do not see the user at the centre and solutions that are not suitable for the user in the future. There is a danger in projects disconnected from the user.

In this context, the study you have read has revealed the process and results of a design problem based on a painful reality that exists in the world and especially in our country. The design



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reactions of the students were observed against a design problem based on principles such as the meaning of the space in the user, its adaptability to the conditions it is in, its flexibility according to the user profile, it's easy and fast manufacturability, and its assembly. The importance of modular design and adaptive space within the framework of post-earthquake sheltering was once again emphasized. With the enrichment of similar studies in the future, it is hoped to develop new and different alternatives for rational, functional and creative living spaces that are not independent from the user.

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**INVESTIGATION OF THE IMPACTS OF FIREFIGHTING APPROACHES ON
HISTORICAL BUILDING AND ENVIRONMENT AFTER THE FIRE**

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ABSTRACT

Historical buildings and their contents are universal as being the common value of all humanity as well as the context and culture to which they belong. Fire, which is one of the biggest factors in the destruction of these buildings, causes losses of life, property, documents transferring to future generations, and the collective memory. Therefore, it is essential to minimize the fire risk of historical buildings and to ensure fire safety before and during the disaster without damaging the original characteristic of the building. In addition, the measures which depends on the content and application methods should not cause any damage on human health, built and natural environment before and after the fire. This study aims to evaluate fire interventions in historic buildings and identify the approach that causes the least damage to the building, its contents, and the environment. In this study, the basic principles of fire interventions in historical buildings were stated; and impact values of the interventions on the building, contents and users were compared. Firstly, the impacts of firefighting techniques appropriate for historical buildings are examined under several headings which are load on building, the effects on component/content, human health, environment, and safety. The required information were obtained from Department of Fire Brigade, material safety data sheets taken from the material manufacturers, and suppliers. As a result, the firefighting techniques which cause the least damage to the historical building, its contents and users were identified, and suggestions were presented in this regard.

Keywords: Historical Buildings, Firefighting, Impact Assessment.

1. INTRODUCTION

Historical buildings ensure the transfer of information about the social life levels of the periods that constitute the immovable cultural heritage. For this reason, they become the common heritage of all humanity. Therefore, historical buildings and their contents should be protected without damaging the building and its contents. Fires in historical buildings cause great damage to the building and the valuable materials it contains. Therefore, it is crucial to ensure fire safety in historical buildings. The factors that constitute the fire risk in historical buildings require a two-pronged approach in terms of ensuring life safety and protecting items. In this respect, many portable and built-in extinguishing agents are used to extinguish and control buildings such as museums, galleries, cultural centers, libraries, and houses to protect them from fire.

It is observed that firefighting approaches may have a great impact on the historical fabric as much as the fire itself. Haydarpaşa Train Station building, which has witnessed history for more



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than a century and is one of the important symbols of Istanbul, burned down during the restoration works on 28 November 2010, and the roof section was severely damaged (Figure 1). In the extinguishing process, the roof of the building was intervened with water from the sea via helicopters and ships. The water used for extinguishing purposes had caused extra damage to the building because the pressure of the salty water was corrosive (Figure 2). In addition, the excessive amount of water caused deposits in the building and the decorations on some of the ceiling tiles were damaged (Ünal & Gündoğdu, 2011).



Figure 1. Haydarpaşa Train Station burned down on 28 November 2010 due to a short circuit in the electrical installation (Source: www.denizhaber.net)



Figure 2. Deterioration in the ceiling due to extinguishing the fire (Source: Istanbul No. 5 Cultural Heritage Preservation Board Regional Directorate Archive)

Another example is Galatasaray University, which is a historical building in Istanbul. It burned down on 22 January 2013, due to the faulty installation of the electrical system, and the second floor and roof of the building were destroyed by the effect of the flames. The extinguishing teams intervened from both land and sea to prevent the fire from spreading to the surrounding buildings. The flames in the historical building, where wooden materials were used intensively, were extinguished with difficulties. As a result of the extinguishing processes with intensive water cannons, serious damage occurred in the building (Figure 3). Consequently, the fire started on the second floor through the wooden walls with a natural convection movement (chimney effect). After that it spread to the roof, and it could not be noticed early because there were no detection and alarm systems on the roof of the building (Kılıç, 2013).

Banner School in Oklahoma City, burned down on 11 May 2014 due to lack of attention and negligence. The historical school which built in 1935 was severely damaged. The dry chemical powder used to extinguish the fire caused additional damage to the items inside (Figure 4)



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Figure 3. Galatasaray University burned down on 22 January 2013 due to a short circuit in the electrical installation (Source: www.yesilgazete.org)



Figure 4. The dry chemical powder extinguisher caused residues and puddles on the items in the historical building. (Source: <https://blog.qrfs.com/211-guide-to-fire-extinguisher-clean-up/>)

There are not enough studies in the international literature on the risks posed by extinguishing methods to the historical building. However, some of the important studies on the subject are as follows. In a study comparing fire extinguishing techniques in terms of human health and environmental impacts, Hodges & McCormick (2013) examined the effects of water, Halon 1301, Heptafluoropropane (HFC-227ea) and dry chemical powder combined with fluorocarbon (CF) (FK-5-1-12) agents. The main purpose of the study is to compare the performance of existing extinguishing agents with environmentally friendly alternatives. In this context, more than 150 tests were carried out indoors and outdoors and the results were evaluated. According to the results, it has been observed that other fire extinguishing agents are not as effective as Halon 1301 and HFC 227ea in meeting the requirements of the US army, but Halon 1301 gas causes significant harm to human health and the environment.

In another study examining the effect of fire extinguishing agents on building materials in historical buildings, Zhou et al. (2023) experienced and analyzed the effects of extinguishing elements containing hydrogen fluoride (HF) on surfaces of historical building materials. For this purpose, 5 hydrogen fluoride-containing quenchers (H-37, FK-5-1-12, H-1323, H-2402 and H-1301) were examined by comparing Fourier Transform Infrared Spectroscopy (FTIR) measurements. As a result, deposits were found in the pores on the wooden surfaces, depending on the amount of fluorine contained in the extinguishing elements, and it was determined that HF caused extra damage to the building content due to its corrosive effect.

Xiaomenga et al. (2010) explained the effectiveness of the water mist system in extinguishing flammable liquid and wood fires with theoretical and experimental methods in their study titled "Extinguishing the Fire Extinguishing Performance of Water Mist Fire Extinguishers in Historic Buildings". The study examined the relationship between water mist and smoke and thermo-physical interaction according to fuels (diesel, gasoline, and wood materials). As a result, it has been concluded that the extinguishing process changes as the properties of the water mist extinguishing system such as flow density, droplet speed and droplet diameter, and that it will be possible to protect historical buildings and users from fire with water mist equipment with appropriate features.



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The main objective of this study is to compare the effects of fire interventions in historic buildings and identify the least damaging approach in terms of the load on the building, the building component/content, the environment, and the impact on human health.

2. MATERIALS and METHODS

Technical information about 9 different approaches used for extinguishing fires in historical buildings was obtained from the fire departments. The safety data sheets of the materials were gathered from material manufacturers and suppliers. These approaches were compared under the headings of the load their equipment creates on the building, the impact on the building component/content, the impact on human health, environmental impact, flash/explosion effect and electrical impact (Table 1). The first of these criteria is the load created by the extinguishing elements on the building. The force acting on the building during an earthquake is directly proportional to the building weight. Therefore, as the building weight increases, the effect of the earthquake will increase relatively (URL-10). For this reason, it should be aimed to reduce the load of the extinguishing elements on the building. Similarly, since the protection of building components against fire is as important as the protection of human health and the environment, these criteria have been determined. In the context of these criteria, the approach that has the least impact on the building and its content was determined and recommendations regarding fire safety were made.

Table 1. Effects of fire intervention approach [URL-1,2,3,4,5,6,7,8]

Fire Intervention Methods	Load on Building	Effect on Building Component/Content	Effect on Human Health	Environmental Impacts	Flash/Explosion	Electrical Conduction
Dry Chemical Powder Extinguishers [URL-1,2]	The load imposed on the building by mobile tubes, which vary between 1-50 kg, is negligible.	The compounds they contain, NaHCO ₃ , KHCO ₃ , NH ₄ H ₂ PO ₄ , can corrode surrounding surfaces and leave stains.	It has no negative effects on human health.	It has known negative effects indoor outdoor environments.	When the compound NH ₄ H ₂ PO ₄ reacts with different chemicals, it causes explosions by releasing flammable gases.	The molten compounds formed during the quenching process can generally pose a danger because they can conduct electricity.
Foam Extinguishers [URL-1,6]	The load imposed on the building by mobile tubes, which vary between 1-50 kg, is negligible.	They can be cleaned easily.	Since they contain Ethanol (C ₂ H ₅ OH) foam may cause irritation when in contact with skin and eyes.	It has known negative effects on the environment where it is sprayed.	There is no danger of flash explosion.	The foam used in the extinguishing process has electrical conductivity and poses a danger because it contains water.
Carbon dioxide Gas [URL-1,5]	The load on the building caused by mobile tubes varying	It does not cause any waste or debris formation	When it mixes with the air, it makes breathing difficult and	Since CO ₂ does not react with many substances, it does not cause	Since CO ₂ gas is not flammable, there is no danger of	CO ₂ does not conduct electricity in both solid and gas phases, so it



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	between 2- after fire a risk of chemical flashing/explosion does not pose a 150 kg is extinguishing suffocation. damage in the . danger. higher than . environment. It foam does not harm extinguishers the ozone layer.
Automatic Sprinkler System [URL-1,3]	The weight of Accumulated Since it contains Thanks to the There is no danger The water used the pipes and water may pure water, it presence of of flash or in the heads of the cause wood does not have deionized explosion. extinguishing automatic and stone any negative water in it, it process is sprinkler materials to effects on human does not have a electrically system rot due to health. negative effect conductive and creates a moisture on the poses a danger. significant problems. environment. Additionally, additional contact with load on the electronic building. devices may cause malfunctions.
Water Mist Extinguishing System [URL-1,8]	Compared to It does not Since it contains Thanks to the There is no danger Since the water the classical cause any pure water, it presence of of flash or used in automatic waste or does not have deionized explosion. extinguishing is sprinkler debris any negative water in wet atomized, it does system, the formation effects on human and dry pipe not conduct weight of the after fire health. systems, it does electricity and pipes and extinguishing not have a does not pose a heads creates . negative danger. less impact on the additional environment. load on the building.
Clean Gas Extinguishing System [URL-1,4]	They need Clean gas Contact with The clean gas There is no danger Clean gas more extinguishing liquid or extinguishing of flash or extinguishing extinguishing systems do refrigerated gas system, which explosion. systems agents, pipes, not leave can cause suffocates and containing one and tanks residue or frostbite. It is neutralizes the or more of the than others to create non-toxic and fire in a short elements extinguish pollution non-corrosive. time, has no Fluorine, the fire. when They are heavier effect on global Chlorine or Therefore, evaporated. than air and can warming. Bromine do not they create O ₂ Therefore, it conduct additional depletion in the does not harm electricity and load on the environment. the ozone therefore do not building. layer. pose a danger.
Covering with Sand/Soil [URL-1]	Due to the Although it It has no negative It has no There is no danger Sand does not formation of does not effects on human known of flash or conduct deposits, it leave health. negative explosion. electricity, so it can create a permanent effects on does not pose a burden on the stains when indoor and danger. building. used to cover outdoor fire, it is environments. difficult to clean



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	compared to others.							
Manual Water Extinguishing [URL-1,9]	Cellulose and textile products absorb excessive amounts of water and can accumulate, creating load problems on the building.	Accumulated water cause and materials of rot and stain due to moisture on the building.	It has no negative effects on human health.	It has negative effects indoor and outdoor environments.	has known effects indoor and outdoor environments.	no In environments, may react on explosive and carbon-containing substances.	closed Contact with electronic devices cause malfunction and completely unusable.	
Extinguishing with Halon Gases [URL-1,7]	They need more extinguishing agents, pipes and tanks. Therefore, they create additional load on the building as they take up more space than others.	Extinguishin g systems do not leave residue and do not create pollution.	It has no negative effects on human health.	It seriously damages the ozone layer because it contains chlorofluorocarbons (CFC). Its use is prohibited in many countries.	There is no danger of flash explosion. it contains chlorofluorocarbons (CFC). Its use is prohibited in many countries.	Halon gases do not conduct electricity, so they do not pose a danger. However, spraying may cause static electricity generation immediately.		

When the table is examined, it is seen that extinguishing systems containing water do not have a negative impact on the environment and human health. However, due to the amount and speed / pressure of water, its accumulation in the indoor environment can cause damage to the building by creating an extra load. Nonetheless, it should not be overlooked that accumulated water causes mold and mildew. Water, which has no danger of flashing or exploding thanks to its physical and chemical properties, can cause an increase in pressure due to high temperature in closed areas, thus bringing the risk of explosion. In addition, water conducts electricity when mixed with substances that can be separated into ions or when it is not pure. It may cause malfunctions in electronic devices. Halon gas causes damage to the ozone layer due to the Chlorofluorocarbon (CFC) it contains. In addition, the need for many tanks and pipes poses a problem in terms of the load it will create on the building. Foam extinguishers cause skin and eye irritation due to the ethanol (C₂H₅OH) they contain. Carbon dioxide gas can harm human health as it makes breathing difficult during the extinguishing process. Extinguishing with sand is not preferred frequently because it is primitive and slower than others. In line with all these criteria, it appears that water extinguishing systems are the least damaging approach among other extinguishing agents. However, it was concluded that automatic extinguishing systems that intervene as soon as the fire starts, prevent its spread in a short time and minimize the damage that may occur are more suitable than manual water extinguishing systems. The automatic sprinkler system creates a disadvantage in terms of the load it imposes on the building



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as it requires more pipes and heads than the water mist extinguishing system. In addition, the water droplet size in the automatic sprinkler system is larger than the water mist extinguishing system, which can cause puddles.

When all approaches are analyzed according to the criteria stated in the table, it is understood that the water mist extinguishing system has the least number of disadvantages compared to the others in terms of building, user, and content safety. (Figure 5).

Fire Intervention Methods	Load on Building	Effect on Building Component/Content	Effect on Human Health	Environmental Impacts	Flash/Explosion	Electrical Conduction
Dry Chemical Powder Extinguishers	+	-	+	+	-	-
Foam Extinguishers	+	+	-	+	+	-
Carbondioxide Gas	-	+	-	+	+	+
Automatic Sprinkler System	-	-	+	+	+	-
Water Mist Extinguishing System	-	+	+	+	+	+
Clean Gas Extinguishing System	-	+	-	+	+	+
Covering with Sand/Soil	-	-	+	+	+	+
Manual Water Extinguishing	-	-	+	+	-	-
Extinguishing with Halon Gases	-	+	+	-	+	-

Figure 5. Comparison of fire intervention methods according to Table 1

3. CONCLUSION and RECOMMENDATIONS

Automatic water extinguishing systems are one of the most effective ways to protect against fire because they are faster than manual water extinguishing systems. In addition, since water mist extinguishing systems have very small droplets, they trap more heat and reduce the temperature of the environment faster than other methods.

For this reason, it is recommended to use water mist extinguishing methods for the protection of historical buildings against fire. However, risks such as excessive amounts of sprayed water or water pressure damaging the items inside should be taken into consideration.

In addition, extinguishing systems in historic buildings should be designed with great care to fully respect the original fabric of the building. It is also advisable to build fire barriers with water mist systems to prevent the spread of fire. In this way, the fire barriers will block the heat and protect the building and its contents from fire within a certain period.

In this context, further theoretical and experimental studies are needed to determine the full potential of extinguishing systems to position the safest, aesthetic, and cost-effective extinguishing systems in historic buildings.



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IMPACT OF BREAK SPACE CHARACTERISTICS ON THE AUTONOMIC NERVOUS SYSTEM AND THE STUDY PERFORMANCE: AN EXPERIMENTAL STUDY

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ABSTRACT

The objective of this study is to highlight the impacts of the public open green space and private enclosed spaces as break spaces on the autonomic nervous system and the study performance of three graduate students using the Pomodoro technique for time management during their studies. The general aim of the research was to establish a relationship between break space characteristics and study performance. We sought to understand how different break spaces influenced overall study progress following the Pomodoro study pattern. Research on environmental enrichment has demonstrated that when animals are exposed to heightened sensory, cognitive, motor, and social stimuli, it leads to behavioral, cellular, and molecular transformations. Nevertheless, limited research on the neurophysiological effects of environmental enrichment in humans exists. This paper focuses on the built environment as a crucial aspect of environmental enrichment and gathers evidence supporting the beneficial impact of green spaces on human well-being. Currently, to assess the impact of an outdoor green environment on body performance, three students from a class were analyzed individually in separate settings under controlled conditions. They utilized the Pomodoro technique and recorded relevant data regarding their body performance after each interval for four consecutive days at fixed hours. In summary, green outdoor spaces may have a positive impact on the autonomic nervous system during break time in a Pomodoro study pattern. Exposure to natural environments during breaks may contribute to stress reduction, relaxation, improved attention restoration, and overall well-being.

Keywords: Polyvagal Theory, Autonomic Nervous System, Pomodoro Technique, Break Space Quality.



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1. INTRODUCTION

The impact of environmental factors on human well-being and performance has been a subject of interest in various fields, including psychology, education, health sciences, and architecture. One crucial aspect of this research focuses on understanding how different environments, such as green outdoor spaces and indoor built-up spaces, can affect physiological responses and overall functioning.

In this study, we examine the data collected from 3 students. The autonomic nervous system plays a vital role in regulating involuntary bodily functions, including respiration, heart rate, and stress responses. By analyzing parameters such as respiratory rate, heart rate (pulse), pain perception, tension in the neck and shoulder muscles, and task performance, we aim to gain insights into how the environment influences these physiological indicators. Previous research has highlighted the potential benefits of green spaces on mental and physical well-being.

The general method employed in our research involved conducting an experimental study to investigate the impact of break space characteristics on the autonomic nervous system and study performance. We compared the effects of public open green spaces and private enclosed spaces as break areas, considering various factors such as greenery, natural lighting, ventilation, temperature, noise levels, and overall ambiance.

The general outcome of our research was to gather data and draw conclusions regarding the influence of break space characteristics on the autonomic nervous system and study performance. We aimed to contribute to the existing knowledge on the significance of environmental factors in creating conducive break spaces for optimal learning and well-being. Specifically, we compare the data collected during study and break periods in the exterior and interior environments. By analyzing parameters such as respiratory rate, heart rate, pain perception, tension in the neck and shoulder muscles, and task performance, we aim to uncover any differences between the two settings. Understanding the influence of the environment on physiological responses and task performance has practical implications for designing optimal learning and working environments. By identifying which settings are more conducive to promoting well-being and productivity, we can potentially enhance educational and work environments to support individuals' overall health and performance. In the following sections, we will delve into the specific data collected from students.

Theoretical Framework

Environmental Neuroscience is a multidisciplinary field that investigates the influence of the environment on human well-being and physiological responses. Numerous studies have highlighted the significant impact of the environment on various aspects of human health and functioning. Ulrich's seminal study in 1984 demonstrated that exposure to natural views through windows positively influenced recovery from surgery, suggesting a connection between nature and healing processes. Building upon this work, subsequent research has further explored the benefits of engaging with nature.

Pretty et al. (2005) found that engaging in outdoor activities, known as "green exercise," resulted in improved mental and physical health outcomes.

Similarly, studies by Van den Berg et al. (2010) have indicated that green spaces act as buffers against the negative effects of stressful life events, promoting better health outcomes.



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Furthermore, Williams et al. (2018) conducted a systematic review and meta-analysis, establishing a relationship between the built environment for housing within the socio-economic status and non-communicable diseases.

The Autonomic Nervous System

Research study investigates how different aspects of green spaces influence the autonomic nervous system, which controls involuntary bodily functions. It regulates various physiological processes in the body without conscious effort (Waxenbaum, J. A., Reddy, V., & Varacallo, M. 2019). The study employs an experimental design to examine the physiological responses of individuals when exposed to varying characteristics of green spaces.

This experimental study exposes participants to different green spaces with varying characteristics. These characteristics could include vegetation density, biodiversity, visual complexity, naturalness, or the presence of water elements (Keniger, L. E., Gaston, K. J., Irvine, K. N., & Fuller, R. A. 2013). The researchers measure physiological indicators of autonomic nervous system activity, such as heart rate, blood pressure, or electrodermal activity.

Nature therapy has emerged as a potential approach to alleviate stress and enhance overall well-being in the past few years. It refers to a collection of methods that aim to induce "preventive medical effects" by exposing individuals to natural stimuli, facilitating physiological relaxation, and strengthening compromised immune functions to ward off illnesses (Jo, H., Song, C., & Miyazaki, Y. 2019).

The scientists can evaluate the influence of various traits of green spaces on the autonomic nervous system by examining the participants' physiological reactions (Lee, J., Park, B. J., Tsunetsugu, Y., Ohira, T., Kagawa, T., & Miyazaki, Y. (2011). For instance, they might discover that exposure to green areas with more abundant plant life or a higher level of natural elements results in a more robust parasympathetic response, indicating a state of greater relaxation. Conversely, green spaces with sparse vegetation or less visual intricacy could produce a stronger sympathetic response, indicating increased arousal or stress.

Polyvagal Theory

Polyvagal Theory (PVT) is a theory proposed by Dr. Stephen Porges, a researcher in the fields of psychology and psychiatry. The theory is based on the idea that the vagus nerve, which plays a critical role in regulating the autonomic nervous system, has evolved over time to allow humans to respond adaptively to social and environmental challenges. According to the Polyvagal Theory, the vagus nerve is divided into two branches, the dorsal vagal complex, and the ventral vagal complex, each associated with distinct physiological and behavioral responses. The dorsal vagal complex is associated with immobilization and shutdown responses, while the ventral vagal complex is associated with social engagement and communication. The theory proposes that the ventral vagal complex is particularly important for human social behavior, including the regulation of facial expressions, vocalizations, and other social cues. The Polyvagal Theory has been influential in the fields of psychology, psychiatry, and neuroscience, and has led to a better understanding of the role of the autonomic nervous system in social behavior and emotional regulation.

The attention given to 'the freeze mode' of Polyvagal Theory has increased in recent years. The theory explains that the dorsal vagal complex activation can lead to a freeze response, which has been characterized by an increase in immobility and a decrease in somatic (mind-body



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connection) activity. The freeze response is interpreted as a form of adaptive behavior that enables survival during threats (Porges, 2011).

Many studies according to Van der Kolk et al. (2007) have examined the role of the freeze mode response in different populations. An example of that is a study of individuals with posttraumatic stress disorder, it was reported that many participants felt disconnected from their bodies and unable to respond to threats during the trauma, which is known as a freeze mode.

Another study of children with a history of abuse conducted by Grasso et al. (2016) found that those with severe experience of abuse were more likely to show signs of a freeze response/mode during a stress-inducing task.

Other studies such as Farber et al. (2018) have explored the neural correlates of the freeze response. They used functional magnetic resonance imaging (fMRI) to identify brain regions that were activated during a pain task designed to elicit a freeze or fight-or-flight response. Their findings show that the dorsal anterior cingulate cortex, associated with attention and emotional regulation, was more active during the freeze response than during the fight mode.

The fight mode is another physiological response apart from the freeze response, which occurs when the nervous system perceives a threat. According to the Polyvagal theory, this response is always controlled by the sympathetic nervous system of an organism. The body usually increases the adrenaline and cortisol production that prepares it to confront the perceived threat and defend itself (Kemp et al., 2017). Kemp et al. investigated the modulation of the cardiovascular system in response to facial expressions of happiness and anger. They found that facial expressions with anger induced an increase in heart rate, which is indicative of a fight-mode response.

Kim et al. (2020), concluded that music can induce fight-mode responses in individuals, which subsequently lead to changes in their heart rate variability. In their study, individuals listened to five different types of music genres, and the results indicated that the controversial music genre aroused the highest levels of fight mode responses. The study suggested that engagements such as listening to music can be used as a therapeutic tool to modulate the PVT response in individuals.

Social Engagement Mode

The social engagement mode, also known as the ventral vagal complex, is associated with feelings of safety, trust, and connection. This state is characterized by an active social engagement system, in which facial expressions, vocalizations, and nonverbal cues are used to communicate and establish meaningful connections with others. Activation of the social engagement mode is associated with increased heart rate variability, improved cognitive processing, and enhanced emotional regulation.

Research has consistently highlighted the importance of the social engagement mode in promoting healthy social interactions and positive interpersonal relationships. By engaging in social engagement behaviors, individuals are better able to establish and maintain connections, build social support networks, and experience a sense of belonging. This mode also facilitates the development of social skills, empathy, and emotional intelligence.

Several studies have investigated the effects of social engagement interventions on various populations, including individuals with autism spectrum disorder (ASD) and those with social



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anxiety. For example, research by Porges and his colleagues (2013) demonstrated that interventions promoting social engagement, such as music therapy and social interaction training, can lead to significant improvements in social behavior and communication skills in individuals with ASD.

Moreover, the social engagement mode has been linked to positive mental health outcomes. In a study by Kok and Fredrickson (2010), individuals who reported more frequent experiences of social connection and positive emotions exhibited increased vagal tone, indicating a higher activation of the social engagement mode. This finding suggests that engaging in positive social interactions can promote psychological well-being and resilience.

The Pomodoro Technique

The Pomodoro Technique is a popular time-management strategy that has gained widespread use in various contexts, including education, business, and personal productivity. The Pomodoro Technique is a time management method developed by Francesco Cirillo in the late 1980s. It is based on the idea of breaking work down into short, focused intervals (usually 25 minutes) separated by short breaks (usually 5 minutes). The method is named after the tomato-shaped kitchen timer that Cirillo used as a student to time his work intervals. The Pomodoro Technique has been shown to improve productivity and focus, reduce procrastination, and enhance work-life balance. However, while many individuals have reported positive outcomes using this technique, there is limited empirical research investigating its effectiveness, for example, Ismail et al. (2022) prove the efficiency of the Pomodoro technique on English students during Zoom classes. This experiment aims to investigate the impact of the Pomodoro Technique on productivity and cognitive performance, using a randomized controlled design. Specifically, we will compare the performance of participants who use the Pomodoro Technique to those who work without structured intervals. By examining the effects of the Pomodoro Technique on cognitive outcomes, this study seeks to provide empirical evidence to support the use of this popular time-management technique.

The fundamental tenet of the Pomodoro Technique is that working in short, concentrated bursts enhances concentration, lessens procrastination, and boosts overall productivity. It keeps people motivated and avoids burnout by segmenting jobs into small chunks and including regular breaks.

Space and Impacts

Kuo, et al (2001) discuss the link between exposure to green outdoor spaces and a reduction in mental fatigue, which they found to be leading to decreased aggression and violence. In their effort to differentiate the sympathetic and parasympathetic activity of Autonomic Nervous System responses by viewing green and built scenes, Van den Berg, et al (2010) used laboratory study (electrocardiography and impedance cardiography signal) on 46 students, the study indicates a greater recovery by viewing green space pictures compared to built spaces.

Abdulhamid, et al (2022) used an adaptive immersive tool named “exobuilding” to measure the accuracy of the behavior of people with alexithymia and concluded it is beyond conscious interoceptive activities.

According to van den Berg et al. (2015), The study indicates that viewing urban green space for five minutes can support recovery from stress by enhancing parasympathetic activity. These findings strengthen the growing evidence base for the health benefits of green space in the



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living environment. However, more research is needed to further understand the physiological and psychological pathways leading from viewing green space to recovery from stress. Their study examined the autonomic nervous system responses to viewing green and built settings, specifically differentiating between sympathetic and parasympathetic activity. The study indicates that viewing urban green space for five minutes can support recovery from stress by enhancing parasympathetic activity. These findings strengthen the growing evidence base for the health benefits of green space in the living environment. However, more research is needed to further understand the physiological and psychological pathways leading from viewing green space to recovery from stress.

2. DATA AND METHODOLOGY

An experimental study will be conducted to collect data from 3 participants during the break & study time in a Pomodoro study pattern.

The participants will be assigned to a green space existence condition for 2 days or a non-green space existence condition for 2 days for data collection individually. The green space existence condition will involve similar green space in the break space environment. The physiological and psychological parameters of participants will be measured using calculations, giving numbers as a self-report. The situation progress and well-being of participants in settled parameters will be assessed using standardized tables and questionnaires.

As part of the class, our team conducted an experiment to examine the influence of break space characteristics on the autonomic nervous system and study performance.

Research Questions

- What are the differences and similarities between the effects of green outdoor spaces and indoor spaces on the internal parameters autonomic nervous system of a human body during break time using a Pomodoro pattern of study?
- How does the existence of green space impact the parameters of individuals during the break time in a Pomodoro study pattern?
- How does exposure to natural versus built environments during breaks impact my stress levels and overall working progress during Pomodoro experiments 2 inside-2 outside break weeks on Sundays?
- What is the impact of studying in the same place but breaks in a natural environment (park, garden, campus) on my body's response compared to spending break time in a room?
- How we can improve the quality of spaces using a study of the human body between relaxation and study periods in green spaces
- Do green and open spaces have the same recovery of mind and body results as home spaces?
- Can someone improve the home spaces' efficiency using the different decorations?

Aim and Objectives

- To investigate the influence of green space existence on the physiological and psychological parameters of individuals during break time in a Pomodoro study pattern.



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- To compare the effects of green space existence on cognitive restoration and mental fatigue during the break time in a Pomodoro study pattern.
- To examine the relationship between green space existence and the perceived stress levels of individuals during break time in a Pomodoro study pattern.

Preliminary Studies

During the preliminary stages of the research, a series of lectures were conducted during which the students were exposed to terminologies, self-awareness, and the process of data collection. A tool in the form of a table or form was constructed using the measurable characteristics of the autonomic nervous. The form was tested and modified, by removing irrelevant and immeasurable parameters. One of the challenges of this experiment is that the observer and the sample under study are the same people. So in the first place, one needs to learn how to collect the data from self without allowing his mind to temper or distort the accuracy of the data being collected.

Self-Observation Experimental Study

Our study involved examining the impact of break space characteristics on the autonomic nervous system and study performance. We focused on comparing public open green spaces and private enclosed spaces as break areas. By collecting data and analyzing the physiological and psychological parameters, we aimed to determine the influence of these spaces.

The study was conducted over a period of four days. Each day, the study commenced at 10:00 AM and ended at 3:55 PM. There were 2 indoor breaks of the study with 2 outdoor breaks of the study, in total 4 days of data collection day.

In our research, we utilized pictures to represent the different break space characteristics, providing visual representations of the spaces under investigation. These visuals helped us analyze their potential influence on the autonomic nervous system and study performance.

To conduct the research, our team followed an experimental study design. Each team member, with the consultancy of the teacher and the three students, participated as research subjects. We assigned individual participants to either the green space condition or the non-green space condition, and data collection took place over four days. During the study and break periods, we adhered to the Pomodoro Technique guidelines for time management.

Data collection was carried out by measuring various physiological and psychological parameters associated with the autonomic nervous system. These included respiratory rate, heart rate, pain levels, tension in the neck and shoulders, and performance/achievement on study tasks. Each team member maintained a record of their experiences and noted any occurrences of back pain throughout the experiment.

During the study, participants were encouraged to maintain a spontaneous eating and drinking routine. Breaks were provided at specific intervals to ensure participants had the opportunity to consume food and beverages. The duration of these breaks was set at 10 minutes, and participants could choose to eat and drink during this time.

Participants were allowed to consume food and beverages of their choice during the breaks. While there were no specific restrictions or guidelines on the types of food allowed, we will discuss the consumption of sugar and caffeine. Some participants opted for foods or drinks that



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contained sugar or caffeine. However, the precise details of individual consumption varied based on personal preferences.

Cortisol, a hormone associated with stress, can be influenced by various factors, including caffeine consumption. In our study, we did not specifically measure cortisol levels. However, previous research in the field has indicated that caffeine intake can potentially affect cortisol levels and stress responses in some individuals. The relationship between caffeine and cortisol levels can vary depending on individual differences and other contextual factors.

Throughout the study, participants were encouraged to be aware of their physical condition and report any changes or discomfort they experienced. Physical condition descriptions varied among participants, but common indicators included muscle tension (such as neck and shoulder tension), and back pain as discomfort. These observations were noted and included during the data collection and analysis process.

3. RESULTS

Student A

The data collected during the experiment on student 'A' generally indicated a slight positive change in the state of the autonomic nervous system parameters under consideration at the break taken in green outdoor spaces than in the indoor built-up spaces. The parameters examined include respiratory (both type and rate), heart rate (pulse), pain on a body part or organ, tension on the neck/shoulder, and performance/achievement on the study tasks carried out between the breaks. The data has shown that the type of breath in both cases (green outdoor and indoor built spaces) remains the same which is diaphragmatic. The respiration rate fluctuates but the average in the outdoor green space is 19.64/minute, while in the indoor built space is 20/minute. The average heart rate in green outdoor space is 64.2/minute, while in the indoor space is 65.4/minute. Much stress and tension on the neck and shoulder were recorded in the case of indoor space than in outdoor green space. There wasn't any pain detected on the body part or organ in each case. Regarding the performance and achievement of the task, it was observed that a little more has been achieved during the activities carried out between the outdoor green space break than those carried out between indoor space breaks.

The above findings are in tandem with the findings of researchers such as Ulrich (1984) who found that patients with a view of nature from their hospital window had shorter hospital stays and took fewer painkillers compared to those with a view of a brick wall. Pretty, et al (2005), Van den Berg, et al (2010), and Cao, et al (2019) also provide evidence of the positive impact of green spaces on mental and physical health outcomes, this includes fewer symptoms of depression and anxiety, reduced stress, improved mood, and increased levels of physical activity which subsequently reduced risk of obesity in children.

Characteristics of the break spaces of student A

The break space in which the outdoor break is taken is in the form of a campus garden with green grass and some shrubs that provide a good view of nature (see Figure 1). The space's temperature is generally moderate, with natural type lighting, ventilation, and green color (vegetation) + blue color (sky). There are many people in the space during the break with intermittent noise coming from insects and birds throughout. While the indoor space is a dormitory common room meant for student relaxation, with about 1 to 4 people during the breaks, the temperature is also moderate, the space does not allow visual contact with nature,



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and the source of light and ventilation is purely mechanical/ artificial. Although there exist multiple colors in the space, the dominant ones are white, red, and light green colors (see Figures 2 and 3).



Figure 1. The green campus garden at Ozyegin University, Istanbul, Turkey, taken by Darma A.U.



Figure 2. Student dormitory common room at Ozyegin University, Istanbul, Turkey, taken by Darma A.U.



Figure 3. Student dormitory common room at Ozyegin University, Istanbul, Turkey, taken by Darma A.U.

Student B

Student B, on the 20th and 21st of April 2023, embarked on a quest to find the perfect tranquil spot in a nearby park to spend her break time. The weather during these two days oscillated between sunshine and occasional clouds, creating a soothing and pleasant atmosphere. She



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aimed to immerse herself in nature, enjoying the beauty of trees and flowers and listening to the melodic sounds of chirping birds and rustling leaves.

Equipped with a thermos of freshly brewed coffee and a delectable slice of cake, Student B set out to explore the park. As she strolled along the winding pathways, she couldn't help but be captivated by the scenic views that unfolded before her. The vibrant colors of blossoming flowers caught her eye, filling the air with their delicate fragrance.

Finding a serene spot beneath the shade of a majestic oak tree, she settled on a comfortable blanket spread over the grass. She had a panoramic view of the park's beauty from this vantage point.

She sipped her steaming coffee and enjoyed the symphony of nature's sounds. The sweet melodies of birdsong echoed through the air, creating a harmonious backdrop for her peaceful interlude. She was entranced by the rhythmic rustling of leaves as a gentle breeze caressed the surrounding trees.

She observed a few families scattered across the park, enjoying their time together. She watched children gleefully playing and parents engaging in cheerful conversations.

The combination of nature's wonders, the temperate weather, and the company of happy families provided the perfect backdrop for her much-needed break. She savored each moment, sipping her coffee and relishing the delightful flavors of her cake.

These two days in the park allowed her to connect with the tranquility of nature, recharge her energy, and find inspiration amidst the serene surroundings. With a sense of contentment, she returned to her academic pursuit.



Figure 4. Student B, outdoor break time, Ata Park, Miandoab, Iran, taken by Arshadi, M.



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Figure 5. Outdoor break time picture at the Ata Park, Miandoab, Iran, taken by Arshadi, M.



Figure 6. student B outdoor break time picture, Ata Park, Miandoab, Iran, taken by Arshadi, M.

Over the two days (23 & 29 April 2023) of experimental studying and having break time inside of the home, student B studied her lessons in her room as seen in (Figure 7). There aren't any windows or natural greenery inside, just like the previous days, with the difference that she spent her rest time in the house (Figure 8). She drank the coffee in the kitchen or living room and conversed with her family members or the guest who had come. Then She returned to her routine of studying in her room

The home environment is pleasant, adorned with flowers and greenery, giving a sense of green space. It also has natural and artificial light in the kitchen and living room.

As mentioned in previous paragraphs, student B has a single study place during her study sessions (Figure 7). Unfortunately, there is no window in her study room to see natural light outside. However, the room is adorned with decorative items such as paintings, dolls, and statues, which create a visually appealing environment.

Student B has a preference for having the best view in each place she occupies. Whether indoors or outdoors, she tries to engage with nature. During her outdoor break time, she seeks out a suitable and comfortable spot in order to have a more enjoyable experience. The outdoor break places depicted in Figures 4, 5, and 6 show a park filled with flowers, trees, and green spaces,



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alongside Zarine Rood, creating a soothing atmosphere. Student B finds these outdoor spaces more rejuvenating during her breaks.

In contrast, the indoor break time takes place in a kitchen and living room decorated with artificial flowers and greenery (Figure 8). Although she has more time for breaks inside the house, student B finds that going to the park and taking a break there is more beneficial, as indicated by her notes after each break. The park's natural setting with flowers, trees, and green spaces provides a more refreshing experience for her.

To summarize, while the indoor break area is designed with artificial greenery, the outdoor park with its natural elements offers a more fruitful break experience for student B.



Figure 7. Student B study place, room. Miandoab/ Iran, taken by Arshadi, M.



Figure 8. Student B Break place, kitchen and living room. Miandoab/ Iran, taken by Arshadi, M.

The analysis conducted by the student after completing each study or rest period was generally done using smart devices such as a blood pressure monitor or an oximeter. The counting of breaths was performed by the person accompanying the student.



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The collected data during the experiment on student B generally indicate a positive change in the status of autonomic nervous system parameters during rest compared to study time. The examined parameters include respiration (both type and rate), heart rate (pulse), pain in a specific body part, neck/shoulder tension, and performance/progress in study tasks between rests. The data have shown that the type of respiration in both conditions (outdoor green spaces and indoor built environments) is relatively similar, characterized by diaphragmatic breathing. However, the average measured respiration rate one minute after rest is lower than the respiration rate measured one minute after studying. The average respiration rate in outdoor green spaces is 15.53 breaths per minute, while in indoor built environments, it is 16.09 breaths per minute. The average heart rate in outdoor green spaces is 86.433 beats per minute, while in indoor environments, it is 86.83 beats per minute.

Based on the obtained average statistics, higher levels of stress, tension, and pain in the neck and shoulder have been observed in indoor built environments (1.93) compared to outdoor green spaces (1.59). In terms of performance and achievement, it was observed that during the activities conducted between rests, better performance was obtained in outdoor green spaces compared to activities conducted between rests in indoor environments

Table 1. The average rates for the outdoor and indoor experiences, prepared by the authors

	Heart (Pulse) Rate / min.	Respiratory Rate / min.
Average outdoor experiences:	86.433	15.53
Average in-door experiences:	86.83	16.09

Green outdoor spaces provide a direct connection to nature, offering individuals a chance to immerse themselves in a natural environment. On the other hand, indoor spaces refer to enclosed environments like rooms or buildings, which may lack direct contact with nature. During break time, both green outdoor spaces and indoor spaces can have an impact on the autonomic nervous system, but the specific effects may vary. Pomodoro Technik helps people recharge, reduce their stress, and to increase their potential during study time.

A comparison of both break time spaces (indoor or outdoor), has found that outdoor spaces have a more positive impact on the body, pain, heart rate, and respiratory rate. Likewise, indoor artificial plants help students mentally to back to work. Thus, in both breaks time, Students' willingness to back to their work tasks increased.

Besides, home spaces can design and decorate with clever ideas based on their personalities. For instance, decorating Artificial plants like a bar cart or using Tropical houseplants can magically soften edgy décor and increase the willingness of individuals to go back to work tasks.

Student C

The data collected during the experiment on student 'C' revealed interesting insights regarding the impact of different environments on the autonomic nervous system parameters. Specifically, the study examined respiratory rate, heart rate (pulse), pain detection on specific body parts or organs, the tension on the neck and shoulders, and performance/achievement in study tasks during breaks.



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The results indicated that regardless of the environment (green outdoor spaces or indoor built-up spaces), the type of breath remained consistent, with diaphragmatic breathing being observed. However, there were slight variations in the respiratory rate, averaging 19.64 breaths per minute in the outdoor green space and 20 breaths per minute in the indoor space. Similarly, the average heart rate was slightly lower in the green outdoor space breaks (64.2 beats per minute) compared to the indoor space breaks (65.4 beats per minute).

Interestingly, higher levels of stress and tension were recorded in the neck and shoulder areas in the indoor space compared to the outdoor green space. No pain was detected in any specific body parts or organs in either environment.

In terms of performance and achievement in study tasks, it was observed that students achieved slightly better results like reading more and succeeding more percentage of the expected workload during the activities conducted between the outdoor green space breaks compared to those between indoor space breaks.

The data collected from student 'C' provides more detailed insights into the effects of different environments on various parameters. Here are the specific findings:

Based on the student c data, the average pulse rates during the study and break times in both the exterior (green outdoor) and interior (indoor built-up) environments are as follows:

Study Time Pulse Average (Exterior): The average pulse rate during study sessions in the exterior environment is 97.6875 beats per minute.

Break Time Pulse Average (Exterior): The average pulse rate during break periods in the exterior environment is 86.85714286 beats per minute.

Study Time Pulse Average (Interior): The average pulse rate during study sessions in the interior environment is 93.125 beats per minute.

Break Time Pulse Average (Interior): The average pulse rate during break periods in the interior environment is 90.14285714 beats per minute.

These pulse rate averages provide insights into the physiological response of student 'C' in different environments. It indicates that during study sessions, the pulse rate tends to be slightly higher in the exterior environment compared to the interior environment. However, during break periods, the pulse rate is slightly lower in the exterior environment compared to the interior environment. These findings suggest that the environment may have a subtle influence on the student's physiological arousal and response.

Diaphragmatic breathing was consistently observed in both the green outdoor and indoor built-up spaces. The average respiratory rate was slightly higher in the green outdoor space, measuring 16.7 breaths per minute, compared to 14.66666667 breaths per minute in the indoor space. This indicates a slightly slower breathing rate in the indoor environment. No specific pain was detected in any body parts or organs in either the green outdoor or indoor space. This indicates that the student did not experience any pain during the experiment.

Higher levels of stress and tension were recorded in the neck and shoulder muscles in the indoor built-up space compared to the outdoor green space. This suggests that the indoor environment may induce more muscular tension and stress in the neck and shoulders.



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The student achieved slightly better results in the study tasks conducted between the outdoor green space breaks compared to those between the indoor space breaks. This indicates a potential positive impact of the outdoor environment on cognitive performance and task achievement.

Overall, the data from student 'C' suggests that exposure to green outdoor spaces during breaks may have a slightly positive influence on the pulse and performance-related parameters. These detailed findings provide a comprehensive understanding of the effects of different environments on the autonomic nervous system parameters. They highlight the subtle differences in respiratory and heart rates, the impact on muscular tension, and the potential influence on cognitive performance. The absence of pain detection in both environments suggests a lack of discomfort during the experiment. These findings further support the notion that exposure to green outdoor spaces may have positive effects, but not with a certainty that includes respiratory rate changes. The respiratory change is different than the other participants and can be related to the heart arrhythmia that the student has or it may be caused by the stairs used to go outside the break area and come back to the indoor study place.



Figure 9. Student C study place, living room. İstanbul/ Turkey , taken by Cumurcu, S.



Figure 10. Student C exterior break place, park. İstanbul/ Turkey, taken by Cumurcu, S.



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Figure 11. Student C interior break place, bedroom. İstanbul/ Turkey, taken by Cumurcu, S.

4. DISCUSSION

The data collected from three different students (A, B, and C) provide valuable insights into the impact of different environments on the autonomic nervous system parameters, including respiratory rate, heart rate (pulse), pain detection, the tension in the neck and shoulders, and performance/achievement in study tasks during breaks.

Student A's data revealed a slight positive change in the autonomic nervous system parameters during breaks taken in green outdoor spaces compared to indoor built-up spaces. The average respiratory rate and heart rate were slightly lower in the green outdoor space, indicating a potential relaxation response. Additionally, higher levels of stress and tension were observed in the neck and shoulder area in the indoor space. Student A also achieved slightly better performance and task accomplishment during activities conducted between outdoor breaks. These findings align with previous research indicating the positive impact of green spaces on mental and physical health outcomes.

Student B's experience in an outdoor park during breaks showed a connection with the tranquility of nature, providing a soothing atmosphere. The data collected from Student B indicated a positive change in autonomic nervous system parameters during breaks, with lower respiratory and heart rates in the outdoor green space compared to indoor spaces. Student B also reported a more rejuvenating experience during outdoor breaks, enjoying the beauty of nature, the sounds of birdsong, and the vibrant colors of flowers. This aligns with the findings of previous research highlighting the benefits of connecting with nature for relaxation and well-being.

Student C's data provided detailed insights into the impact of different environments on autonomic nervous system parameters. The results showed slightly higher pulse rates during study sessions in the green outdoor space compared to the indoor built-up space, suggesting a potential physiological arousal. However, during break periods, the pulse rate was slightly lower in the green outdoor space. The respiratory rate was slightly slower in the indoor environment, indicating a potential relaxation response. Higher levels of stress and tension were



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observed in the neck and shoulder area in the indoor space compared to the outdoor space. Student C achieved slightly better performance during activities conducted between outdoor breaks, suggesting a positive impact on cognitive performance.

The data from all three students suggest that exposure to green outdoor spaces during breaks may have a positive influence on autonomic nervous system parameters and cognitive performance. The findings align with previous research demonstrating the benefits of green spaces on mental and physical health outcomes, including reduced stress, improved mood, and increased levels of physical activity. However, it is important to note that individual experiences and responses to different environments may vary.

The characteristics of the break spaces varied among the students. Student A had access to a green campus garden during outdoor breaks, providing a view of nature with moderate temperature and natural lighting. In contrast, the indoor space was a dormitory common room without direct visual contact with nature, with artificial lighting and ventilation. Student B chose a nearby park with trees, flowers, and green spaces for outdoor breaks, experiencing the beauty and tranquility of nature. The indoor space was decorated with artificial greenery, creating a visually appealing environment. Student C had an interior break space in the bedroom and an exterior break space in a park, both in different locations. The interior space had artificial lighting, while the exterior space provided a natural environment with trees and greenery.

In conclusion, the analysis of the data collected from three different students suggests that green outdoor spaces have a positive impact on autonomic nervous system parameters and cognitive performance during breaks. These findings are consistent with previous research highlighting the benefits of connecting with nature for relaxation, stress reduction, and improved well-being. However, individual preferences and responses to different environments may vary. Creating break spaces that provide access to nature and incorporating elements of greenery, natural lighting, and ventilation in indoor environments may contribute to a more rejuvenating break experience and enhance overall well-being.

Limitations

Throughout the study, the research team made efforts to ensure the smooth execution of the research protocol. Minor changes, if necessary, were implemented to address unforeseen circumstances or participant feedback. These changes were recorded and considered in the final analysis to ensure the integrity and validity of the study findings.

5. CONCLUSION and FUTURE DIRECTIONS

Green outdoor spaces, such as parks, gardens, or campuses, provide a direct connection to nature, while indoor spaces refer to enclosed environments like rooms or buildings. Both green outdoor spaces and indoor spaces can have an impact on the autonomic nervous system during break time. However, the specific effects may differ. The existence of green space during break time in a Pomodoro study pattern can have several positive impacts on individuals. It can promote relaxation, stress reduction, and restoration of cognitive resources. During the Pomodoro experiments, alternating between natural (outdoor) and built (indoor) environments during breaks can potentially impact stress levels and overall working progress. Natural environments may enhance relaxation and recovery, while built environments may offer a controlled and focused setting for studying. Studying in the same place but taking breaks in a natural environment can have a different impact on the body's response compared to spending



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break time in a room. Natural environments may provide a sense of rejuvenation, increased attention restoration, and reduced mental fatigue. To enhance the quality of spaces for studying in green environments, it is essential to consider the balance between relaxation and study periods. Providing comfortable seating, access to natural elements, adequate shade, and minimal distractions can optimize the benefits of green spaces for both relaxation and focused study. Green and open spaces can have a similar effect on the recovery of the mind and body compared to home spaces. However, the specific results may vary depending on individual preferences, the design of the home environment, and the extent to which the home provides a sense of calm and relaxation. In summary, green outdoor spaces can have a positive impact on the autonomic nervous system during break time in a Pomodoro study pattern. Exposure to natural environments during breaks may contribute to stress reduction, relaxation, improved attention restoration, and overall well-being. Designing and utilizing green spaces effectively can enhance the quality of study environments and promote optimal balance between relaxation and focused work.

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THE MEDIATION OF ARCHITECTURE BETWEEN THE PAST AND THE PRESENT IN TROY AND ACROPOLIS MUSEUM

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ABSTRACT

Archaeological museums serve as apparatus that visualize the past by transferring knowledge into specific spatial arrangements. Examining the practices of museumization in history, a representative model became an apparatus for the Enlightenment ideology; however, it underwent typological transformations in the twentieth century, particularly within the debates on post-colonial 'new museum theory,' leading to epistemological questioning. In this process, architectural articulation emerged as a crucial aspect of museum design, particularly from the 1960s onwards. For approximately thirty years, archaeological museums, especially the ones designed in Europe, have been established in or around archaeological sites. They either have a visual connection or direct contact with the ruins and demonstrate architectural inventions related to the site's context. From this perspective, the museum turns into an optical apparatus that reconstructs the past through gazing. This research focuses on architectural devices in archeological museums, specifically analyzing Turkey's Troy and Greece's Acropolis Museum. The study critically examines the role of architectural design in shaping these two museums within the current context. By exploring how these new architectural fictions and tactics help to represent the past, the study aims to offer insights into the contemporary position of archeological museum design.

Keywords: Archaeological Museum Design, Archaeological Site Museum, Visual Device, Past, Representation.

1. INTRODUCTION

The archaeological museum mediates between us and the past. Despite the fragmentation and incompleteness of the archaeological materials, it constructs a narrative out of them. The museum is a medium where this narrative is visualized and presented to visitors. Archaeology, on the other hand, translates its investigations and interpretations into writing. In this regard, Greek archaeologist Hamilakis (2020) distinguishes the knowledge produced by archaeology from the intrinsic entity of material remains. Both practices construct their objects with their respective tools and methodologies. However, as Czech philosopher Flusser (1990) pointed out, mediation is inherently distorting. All representations created by humans to understand and explain nature ultimately deviate from their original purpose and produce unintended meanings. Therefore, it seems crucial to explore the mediation of museums in our ways of understanding and representing the past.

The research focuses on the role of architectural design rather than display and curatorial policies of museums, as architecture has become one of the prevailing inputs in museum design, influenced by modernism throughout the twentieth century. Particularly in the 1960s, epistemological shifts gave way to critical inquiries under the 'new museum theory' (Marstine, 2006) on the colonial history of museums. As a result of this critical discourse, the universal



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museum model gave place to innovative attitudes of museums like the Moma, the Guggenheim Museum and the Pompidou Center (Hoffmann, 2016). Besides, in the case of archaeological museums, various new museum practices have emerged in response to the development of national archaeology and necessitate their architectural models.

However, starting from the late twentieth century in Western geography, one of the most significant developments specific to archaeological museums is their aim to engage with archaeological sites. Within the scope of this study, archaeological museums designed in Europe from the 2000s onwards, along with mixed-collection museums with archaeological collections, have been examined, and a total of fifty-nine museums from various countries were evaluated. An important finding is that fifty archaeological museums are regional or site museums. This case signifies a shift away from the universal museum practices that possessed treasures from all corners of the world, replacing them with local museums. Another finding is the increase in on-site exhibitions. By this, eighteen museums have been built upon archaeological remains. However, concerning the twentieth century, out of sixty-one museums considered, only two engaged in in-situ exhibitions.

The archaeological site museums in question construct the narrative of the past in various contexts. These contexts may be geographical, topographical, or even a single archaeological fragment. However, their common feature is the inclusion of archaeological remains within the field of vision. Among these, the Troy Museum from Turkey and the Acropolis Museum from Greece are prominent examples of archaeological museums designed in the 2000s. They have significant achievements in terms of their visual qualities. The Troy Museum addresses the ancient city of Troy within the Troas region. It inclines to establish a connection with the geography. The Acropolis Museum, on the other hand, has taken a close-up approach to the Athens Acropolis and particularly the most significant structure within the Acropolis, the Parthenon temple. Despite engaging with the past in different contexts and through various instruments, both museums question the traditional visions of museums. In this article, the architectural designs of the Troy and Acropolis Archaeological Museums are discussed within the context of the visual device metaphor, thus evaluating the potential of architectural design in terms of representation of the past.

2. MATERIALS and METHODS

Establishing a relation between the archetype of the museum and the *camera obscura*, which is an integral element of the same epistemological paradigm, is seminal to exploring the distinctive qualities of contemporary museums that differentiate them from the typology of Enlightenment museums. Importantly, these connections are entirely conceptual, avoiding the construction of a physical resemblance. Moreover, it is essential to recognize that it is impossible to examine a museum solely from the perspective of a single device. The optical devices, likewise, are complex inventions in terms of being "points of intersection where philosophical, scientific, and aesthetic discourses overlap with mechanical techniques, institutional requirements, and socioeconomic forces" (Crary, 1992).

Camera obscura, meaning "dark room," is a device that, despite being an optical technology, is often referenced for its ideological implications. In the nineteenth century, thinkers such as Marx, Bergson, and Freud regarded it as a device that conceals reality and even transforms it into an illusion. The observer's confinement within an enclosed space and the inability of the device to establish a connection with the outside world contribute to the enigmatic nature of



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this illusion (Crary, 1992). "Thus, the *camera obscura* isolates consciousness, separates it from the real" (Kofman, 1999), and creates an impermeable boundary between the inner and outer worlds. From this perspective, it is possible to interpret the device as a reflection of the first museum model.

The interest in antiquity as a phenomenon and the fascination with it began with the Renaissance. The concept of the exhibition first emerged as the arrangement of notable items, known as the "cabinet of curiosities," based on the personal interests of monarchs and princes in their highly private chambers (Artun, 2018). With time, as princes started to open their collections to a specific community gradually, they evolved into galleries. However, the development of museums as a specialized field intertwined with Enlightenment ideology. The random exhibitions in princely chambers began to be categorized and systematized during this period. The design of museum spaces also reflected these differences. The plan proposed by Jean-Nicolas-Louis Durand in the late 18th century, which served as the basis for the following museums, is based on a schema where different selections are presented together (Pevsner, 1997). The neoclassical museums of the 19th century offered visitors a divine spectacle by isolating them ideologically and physically from the external world. Indeed, the perception of being enveloped in an inner space is quite strong in these museums. Features such as stone walls and partial openings of the structure performing for light sources rather than visual contact enhance the idea of an isolated inner world. Carol Duncan (2006) argues that the archetypal form of the museum reminds of pre-modern temples. For example, a grand colonnaded entrance and staircase prepare the visitor for a divine journey. Monumental gateways adorned with impressive sculptures maintain the idea of a sacred place inside the museum. In the exhibition, spatial arrangements specifically demand the museum visitors' attention. The most exclusive pieces of the collection are displayed prominently, often in the most exceptional location within the museum. For instance, one of the most important exhibits in the Berlin Neues Museum, completed in 1955, is the bust of Nefertiti. The bust is displayed alone in the center of the northern rotunda, illuminated by natural light from above.

In a Marxist sense, the allusion of such a type of exhibition arises precisely from the exclusion of the physical conditions under which these objects were produced. In other words, artifacts of the Enlightenment museums were transported from the cities where they originated to Western cities, often thousands of kilometers away. Consequently, universal museums eliminate the context of archaeological sites. However, site museums can maintain the connection between archaeological fragments and the site. In contrast to many site museums that do not take advantage of this possibility, recent museums like the Troy and Acropolis Museums stand out for their efforts to establish this connection. The research focuses on understanding how these two museums have developed optical mechanisms.

3. FINDINGS and DISCUSSION

The Troy Museum, established in the context of the ancient city of Troy, was relocated with the transfer of the Çanakkale Regional Museum. It is situated approximately 800 meters away from the archaeological site, built within a landscape surrounded by cultivated fields. From a distance, the structure looks like an obscure box with very few facade openings, making it unclear whether one can enter it. This box evokes the concept of a dark chamber, reminiscent of *camera obscura* (Figure 1). As one approaches the building, a ramp descends downwards as an extension of the topography, providing access to the interior. Nevertheless, even now, there



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is no indication of what occurs inside. The entrance floor is below the ground level. As we enter, the outer façade is revealed again through the glass roof of this floor (Figure 2). Up to this point, the museum is an apparatus that displays its exterior rather than its interior.



Figure 1. The Troy Museum



Figure 2. The glass roof and the view of the facade on the ground floor

The opaque mass seen from the outside comprises gallery floors and a circulation ramp that connects these floors. Inside the volume, the galleries are arranged in succession, resembling the layers of Troy. The collections are exhibited thematically on each floor, and the objects are freely displayed in the central area. The ramp traces a circular path between the façade and the floors (Figure 3). As we move through the ramp, the view of the geography upon which the museum and the ancient city were once built is revealed from the partial openings in the façade. Along with the circulation, the perception of the building's opacity begins to break, and the present-day view of the landscape starts to unfold (Figure 4). As a result, the archaeological fragments and the images of the site the fragments were excavated from come in sequences as in a cinematic montage.



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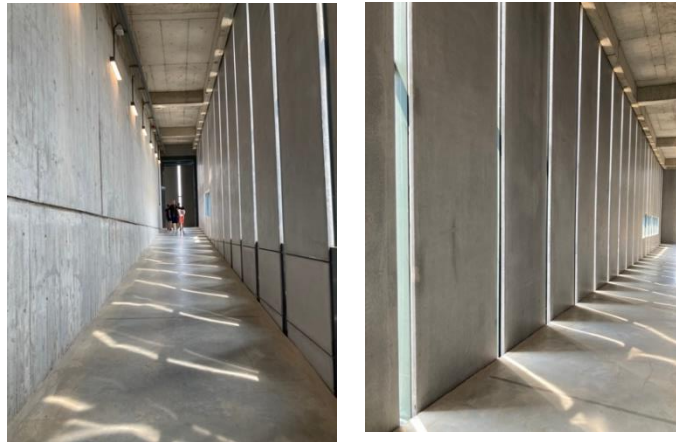


Figure 3. Circulation ramp



Figure 4. Troas view from the openings on the facade

The circulation space defines a void within the building, temporarily suspending the exhibition and allowing the exterior world to infiltrate the museum. The spatial void turns into a mnemonic void, recalling the fragments of the museum's narrative. Thus, the museum's two architectural elements - the facade and the ramp- compose a montage apparatus that operates as a tool for imagining the past along with the present. As two temporalities - the past and the present - and two spaces - the interior and the exterior - intersect, our sight also splits between them, losing its central position.

The ramp finalizes its route at the top of the building, which is a periscopic terrace, allowing one to observe Troy's ancient foundations from all perspectives. Here, we find nothing but the bare view of the landscape. Observers are left face-to-face with the emptiness of the site to reconstruct the past in their memories.

On the other hand, the new Acropolis Museum is the outcome of the fourth attempt at an architectural competition organized to meet the need for a new museum due to the insufficiency of the old museum within the Acropolis for new findings (Pandermalis, 2017). Compared to the geographical context of Troy, here, we find an approach that focuses directly on the Acropolis itself. While the Acropolis of Athens continues to stand as a landmark in the dense



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urban fabric of modern Athens, the museum positions itself within this urban context, facing the Acropolis from 300 meters. In contrast to the exterior of the Troy Museum, it is transparent due to its extensive glass surfaces. Furthermore, it presents a more dynamic and interactive impression with different geometries, materials, and mass openings (Figure 5).



Figure 5. The Acropolis Museum

Similarly, the exhibition areas arranged within the museum have different characteristics, supported by spatial differences such as size, height, and geometry, corresponding to the thematic variations of the displayed fragments. Just before entering the building, ancient artifacts beneath the ground are visible through a gap in the floor. The structure rises on pilotis like a protective cover over the ruins. The findings along the path leading to the rock are displayed on the ground floor. Although located on the same level, the two galleries on the first floor are separated by an intentionally created void within the building. Without dividing walls, these open-plan galleries host fragments related to Athens' archaic and Roman history. The gallery on the top floor is entirely dedicated to the frieze and pediment sculptures of the Parthenon temple. The circulation scenario of the museum is designed not according to the sequential order of the floors but based on the exhibition themes. Vertical circulation elements are placed at both ends of the building so that visitors can move throughout the length of the museum and follow a new route on their way back. The museum views modern Athens from all its facades while it gazes at the archaeological site above the rock from the north facade. In this regard, the museum resembles an observatory where we can observe the Acropolis directly; it directs its telescope toward the sky, watching the archaeological fragments standing 150 meters above the ground. However, this telescopic mechanism enables the ability to see the Acropolis without any obstruction and the installation in the Parthenon gallery (Figure 6).



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Figure 6. The view of the Acropolis through The Parthenon Gallery

The Parthenon temple is the symbol of the Acropolis and Athens. The Parthenon gallery, as if confirming this, is the most important fragment of the museum. Designed as a glass box, this structural part of the building is deliberately shifted from the axis to become parallel to the temple. The unique construction designed to exhibit the frieze and metopes of the Parthenon resembles the temple's cella itself. Moreover, marble sculptures are placed according to their original positions. Even the sculptures on the pediment are displayed on the ground in their original orientations (Figure 7). The Parthenon gallery allows visitors to see the constructed fragments and the temple together. Metaphorically speaking, the glass panel of the gallery acts as a telescopic lens, magnifying the image of the source object and displaying it in the gallery. Thus, the friezes brought to eye level can be examined in detail. By overlapping the external image of the Parthenon with the representational one inside, the missing fragments are embedded in their original places fictionally. Thus, the museum begins to function as a representation apparatus where the image of the past is reconstructed within the present moment. The gallery is a well-lit room that engages with external reality rather than eliminating it.



Figure 7. Construction of the Parthenon friezes, metopes, and sculptures



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4. CONCLUSION and RECOMMENDATIONS

Archaeological museums, which have freed themselves from the conventional spatial and narrative models throughout the twentieth century, today mediate between the archaeological past and us primarily through architecture. This mediation also places architectural design in an essential position in representing the past, as much as curatorial preferences. Architecture plays various roles in this process. For example, the Troy Museum design aims to engage with geography. In contrast, the Acropolis Museum aims for a more direct relationship with the archaeological site by focusing on a fragment of the Athens Acropolis, the Parthenon Temple. Although constructed in different contexts, both museums invite the exterior world inside rather than creating an enclosed indoor space. The Troy Museum transforms into a montage apparatus, allowing us to construct the past by juxtaposing images of exhibited archaeological objects with the present-day views of the landscape from which these artifacts were excavated. The Acropolis Museum, on the other hand, serves as a telescopic device that allows us to observe the Parthenon in its original location while magnifying its details for us. As a result, in both museums, the gaze constantly shifts between times and spaces, disrupting the consistency of representation.

Thanks and Information Note

1. All images are the property of the author.
2. This article covers the process of the ongoing Ph.D. study under the supervision of Ayşe Şentürer at the Istanbul Technical University, Graduate School, Architecture Department, Architectural Design Doctorate Program.

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**NATURE-BASED SOLUTIONS IN SUSTAINABLE ARCHITECTURE AND
INVESTIGATION OF THEIR USE IN TRADITIONAL HOUSING TEXTURES**

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ABSTRACT

Housing has been a shelter for people left unprotected in nature and a problem that has been sought to be solved in architecture from past to present. In this study, houses in different natural environments were examined in terms of ecological and sustainability principles. It is especially important to examine rural houses, which exist in rural settlements where natural life principles are seen more than in cities and are considered as local/traditional architectural products. On the other hand, Sustainable Architecture is one of the current issues of architecture and directly affects global policy making. Within the scope of this study, rural housing patterns were examined in terms of sustainability. The study is limited to rural settlement patterns covering 10 different villages in Başkale district of Van province, located in the east of our country.

Keywords: Vernacular Architecture, Sustainable Architecture, Başkale Rural Housing.

1. INTRODUCTION

One of the most important problems since the beginning of human history has been housing, and housing production has been undertaken to solve this problem. With the development of technology and the differentiation of needs, more planned and functional structures were produced, thus the concept of architecture was formed. The pandemics and then the earthquakes that have occurred in the last few years have provided opportunities to rethink cities and especially the residences we live in and to critically examine the existing ones. Although difficult, this process has shown that there is no solution other than building ecological and sustainable buildings and residences in nature, in harmony with nature and belonging to the place.

Rural houses have ecological values due to their natural harmony with their environment are closely related. As a matter of fact, the concept of ecological structure is intertwined with nature and does not depend on production. that does not harm the nature and is self-sufficient in terms of energy efficiency It includes structures. Therefore, rural houses have a significant impact on ecology with their prominent features. They adapt more to structures (Zorlu and Faiz, 2012).

Architecture that is compatible with ecological values also includes the concept of sustainability contains. Sustainability, especially in the new world where consumption increases. As the destruction of the environment, which is the main problem of society, becomes visible, came to the fore together. Thus, sustainability can be defined as the continuation of the use of natural resources and also allowing the use of these resources in the future (Serin, 2011). In addition, sustainability has a wide scope that includes many different branches. In this respect, sustainability principles that include environmental, social and economic elements, It also directs the discipline of architecture (Özer and Oral, 2017).



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In the ecological architecture approach, the basic principles are to examine the environment and climatic values in which the building will be located. The role of buildings in uncontrolled energy consumption, which is shown to cause threats up to global climate changes in the world, is quite high (Gökşen, Güner and Koçhan, 2017). Thus, ecological architecture includes, on the one hand, benefiting from environmental data and renewable energy resources, and on the other hand, reducing the impact of the building on the ecological system, planning the construction-use-maintenance-demolition phases of the building, effective use of energy, materials and water, and ensuring people's mental and physical comfort conditions (Serin, 2011).

Although the concept of sustainability has become widespread today as a new concept, it is possible to find its foundations in the past. In this context, when traditional architectural structures are consciously analyzed, it can be seen that sustainable and ecological values were considered long ago. Based on this idea, some scientists argue that the foundations of sustainability lie in the past. They even state that ecological criteria can still be followed and benefited from in rural areas of third world countries (Özer and Oral, 2017). Based on these thoughts, it is an important issue to consider traditional architectural structures within the framework of ecological criteria. It is especially important to examine rural houses, which exist in rural settlements where the principles of natural life are more prevalent than in cities, and are considered as local/traditional architectural products. Considering that these experiences are in danger of extinction as a result of the abandonment of local techniques and materials today, the cultural heritage in rural areas needs to be documented. In this way, it will be possible to play a guiding role in the structures to be built in the future. Therefore, it is necessary to investigate in detail the answer to the question of what kind of houses are unique to the geography, topography, climate and region where they are located and compatible with nature, and how solutions are made in nature. Research conducted in this context has revealed the importance of focusing on traditional and local identities and traditional housing patterns and examining these textures, especially in terms of sustainability and ecological aspects. Van Başkale Rural Houses, which are discussed within the scope of the study, are shaped according to the characteristics of the geography in which they are located and are thought to be remarkable in terms of ecological values.

Information About Başkale

Başkale district, located on the Van-Hakkari road, is 20 km from the Iranian border and the Van city center. It is 112 km away. The district is located in the upper basin of the Zap River, near the İspiriz (Başkale) mountain. It is located in the foothills. On the northern border of the district is Saray, a district of Van; in the east, the Turkish-Iranian border; in the south, Yüksekova, a district of Hakkari and in the west, a district of Gürpınar, a district of Van (Figure 1). The district, which has a very mountainous and rugged geography, consists of a valley surrounded by high mountain ranges extending in the north-south direction. Its surface area is 2599 km and its altitude is 2460 m above sea level. The average number of snow-covered days is 140 days (Kılıç, 2006:31).

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Figure 1. Başkale Map (URL-1)

History

It is seen that Başkale was a border region between the Parthians and the Romans in the past. The region later came under the rule of the Sassanids in the 3rd century, and in the 6th century it came under the rule of the Byzantines. After remaining under the rule of local Armenian lords after 645, the district was taken over by the Ahlat Shahs, who were established in the 12th century. However, the region, which was attacked by the Mongols in the 13th century, remained under the rule of local lords for a while. This situation lasted a short time and the region came under the rule of Timur and then the Karakoyunlu. It came under the rule of the Safavids in the early 16th century. The region was annexed to the Ottoman Empire in the mid-16th century. The district, previously known as Kotur-Elbak, was known as the Elbak district of the Hakkari sanjak of the Van province in the late 19th century (Figure 2). (Kılıç, 2006:31).



Figure 2. A photograph from Başkale District Center, thought to date back to the 1900s (URL 2)

Socio-Cultural Life and Economy

The daily life of the people in Başkale rural area is shaped around their livelihood and cultural activities. People are busy with work such as grazing animals and mowing grass in the summer, and in the winter months, if it snows, they are busy with cleaning the roof and taking care of the animals.



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Unlike many other rural settlements, in Başkale, men rather than women are seen to work more actively in jobs such as animal care. Herbed cheese, which is produced abundantly in the region with the milk obtained from animals, is also widely made in Başkale. The tandoor, which used to be lit every day to meet the bread needs of the household, is now burned once a month.

The main source of income of the people in Başkale district is animal husbandry. Raising small livestock, especially sheep, is common. Milk, cheese and yoghurt are produced from animal products, and these products are mostly used for the daily needs of the household. Although agriculture is not very developed in the district due to harsh climatic conditions and scarcity of plant production areas, wheat, barley and potatoes are the main products grown. The district is adjacent to Iran, but since there is no border gate, border trade cannot take place.

Some families, depending on their economic sufficiency, have a house where they stay in Başkale district center or Van center. These families stay in the town or city in winter and in the village in summer. Transhumance activities, which have an important place in the culture of the region, continue, albeit to a lesser extent. It is observed that some of them had to leave the villages completely due to reasons such as village evacuations and worsening economic conditions, and as a result, houses with locked doors became increasingly unusable.

Important Natural And Historical Values In Başkale

There are buildings of historical architectural value in Başkale, which has been a residential area since ancient times. In addition, it is a settlement with natural beauties. Ispiriz Mountain, located within the district borders, is an important natural area with its rich flora and fauna. Kelegom, a hot water source 6 km away from Başkale (Figure 3), the edge of Batkam Creek right at the entrance of the district, and the edge of Değirmen Creek 3 km away from the district, are the main recreation and picnic areas (Kılıç, 2006).

Some unique landforms formed as a result of natural processes can be found within the district borders. In Akçalı village, there are karstic travertines with dimensions of approximately 100 x 200 m (Figure 4). In addition, the fairy chimneys in Yavuzlar village are a natural resource with high touristic value (Figure 5), and the traces of the St. Bartholomeus Monastery, one of the religiously important buildings, are still standing (Figure 6). (Elmacı and Sever, 2011).



Figure 3: Kelegom Bridge (URL-3)



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Figure 4: Travertines in Akçalı Village of Başkale (URL 4)



Figure 5: Fairy chimneys in Yavuzlar Village of Başkale (URL 5)



Figure 6: St. Bartholomeus Monastery (URL 6)

2. MATERIALS and METHODS

In this study, houses in different natural environments were examined in terms of ecological and sustainability principles. The study is limited to the rural settlement patterns of Başkale district of Van province, located in the east of our country. In the on-site investigations covering 10 different villages, it was determined that they had similar settlement and structural features,



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and that they were architectural formations compatible with nature without disturbing the topography, climate, natural resources and most importantly, nature.

3. FINDINGS and DISCUSSION

General Architectural Features Of Başkale Rural Residences

The physical environment and socio-cultural and economic factors that were effective in the formation of rural houses were also effective in the formation of Başkale rural houses. The geography of the region, consisting of mountainous and steep terrain, plays an important role in shaping the architecture. As a matter of fact, this geographical structure means that the settlements are scattered and far from each other has been effective in its development. At the same time, architectural solutions suitable for the sloping land structure have been developed (Figure 7).



Figure 7: Views from Başkale countryside

The crowded family and tribal structure of the region is also reflected in the architectural planning. However, despite this, very large sizes and complex plan types are not encountered in the formation of houses. Considering their availability as building materials in the region, the use of adobe, stone and wood is at the forefront. Construction techniques and material selections were formed under the influence of geographical and climatic conditions, as in other regions of Anatolia. In the rural houses of Başkale, adobe was mostly used as a building material on a stone foundation. However, examples of stone materials used in their walls can also be found. The houses were built with wooden beams and flat earthen roofs (Figure 8).



Figure 8: Başkale rural houses built with adobe, stone and wood materials

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The houses were built as single and two-storey. This is shaped according to the size and economic conditions of the family. Although there are generally no garden walls, the existing ones are either made entirely of stone material or the bottom is made of stone and the upper part is made of adobe (Figure 9).



Figure 9: An example of rural housing from Başkale villages

As in other Eastern Anatolian residences, in Başkale Rural Residences, tandoor, cold it is an element that makes life easier in climatic conditions (Figure 10). Therefore, the main center of the residence It can be said that it is. In cold and long winter seasons, thanks to the tandoor, both the entire house and the household warms up by sitting around the tandoor.



Figure 10: The most important place of rural housing is the tandoor house and the tandoor

The place where animals are kept in the countryside of Başkale, where the main source of income is animal husbandry. It is seen that the barn is always included in housing planning. The barns, called gov in the region, are mostly adjacent to the house and are located at the back of the house (Figure 11). Entrances are generally thought to be a little away from the living area.

The toilet is not located inside the house, but is located outside and in a separate place, usually in an inconspicuous place. Examples of this type of toilets made with local materials and techniques in full circular form attract attention (Figure 12). Just like the kitchen and bathroom, the toilet was either added to the building later as a new space or an existing section was converted into a toilet and continues to be used.



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Figure 11: An example of a barn in the countryside of Başkale



Figure 12: Circular-shaped toilet located outside, close to the house

4. Başkale Rural Residences In Terms Of Ecological Criteria Evaluation

Başkale rural residences will be discussed under the headings of topography and orientation, climate, form and plan fiction, building materials and waste management, which are considered ecological architectural criteria.

Topography and Orientation

Başkale's geographical conditions are quite rugged and challenging. The geography, consisting of mountains and large and small hills, becomes more evident in the countryside. Village settlements are generally established on the slopes of mountains or on the hills of plains. There is inevitably a natural slope of the land. However, the villages in the observed area are located on topography with wider plains rather than very steep slopes.

Houses were generally tried to be placed on flat ground. It was fed into the subgrade and a level environment was created in the house. In more sloping areas, the main production spaces of the house, such as barns and tandoori houses, were built and a method suitable for the shape of the topography was followed.

In addition, due to the earthquake effect, buildings are generally single-storey, although there are at most two-storey ones. The roofs of buildings located on sloping lands descend gradually.



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Thus, there are examples where it is possible to pass from the roof of one house to another. Same in places where there are many parts buried in the ground, no stairs should be installed on the roof. It can be easily exited without using it (Figure13). The orientations are based on the rooms and rooms occupied by the very harsh climatic conditions of the region. Entrance doors are oriented towards the south or east to receive more sunlight.



Figure 13: Housing texture positioned according to topography (Upper cluster /Rêkan village)

Climate

It can be said that the planning and dimensions of Başkale rural houses are largely shaped by the climate. As a matter of fact, it is seen that the climate of the region is determined by the cold continental climate in terms of the location and dimensions of the tandoori house. Especially in the oldest housing examples that have preserved their original structure, the tandoori house is located inside, like any other room in the house, in connection with the sofa. Its dimensions are larger than other spaces and it also functions as a kitchen. There is also usually a bath stone in one corner. All areas of the house are heated by the tandoor that is frequently lit. Similarly, if the barn is adjacent to the house, the temperature of the animals can be utilized in the house as well. Depending on the topography, the majority of the buildings are tandoori houses and barns, which are partially or completely buried in the ground (Figure 14).



Figure 14: Interior view of multi-purpose tandoori house

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When the street structure in Başkale rural settlements is examined, it is seen that the houses are generally not located very close to each other and the streets are wide. It is thought that this situation was consciously chosen so that the houses do not block each other's sun and to benefit from the heat at the maximum level. However, it is built on a ridge

There are also some examples in settlements where houses are built almost adjacent to each other in order to be less exposed to the effects of strong winds (Figure 15).



Figure 15: Wide street structure on flatter land and narrow streets on sloping land

The spaces are kept in average sizes to meet the needs of families even if they are crowded and not to increase heat loss. In addition, wall thicknesses, which are generally kept between 56-80 cm, serve as insulation between the external environment and the internal environment. exterior facades straw.

It was plastered with mixed mud plaster. Especially in the oldest houses, it is seen that transparent surfaces are used very rarely on the facades, in accordance with the climate of the region. As a matter of fact, it was determined that window and door sizes were kept at very minimal sizes (Figure 16).

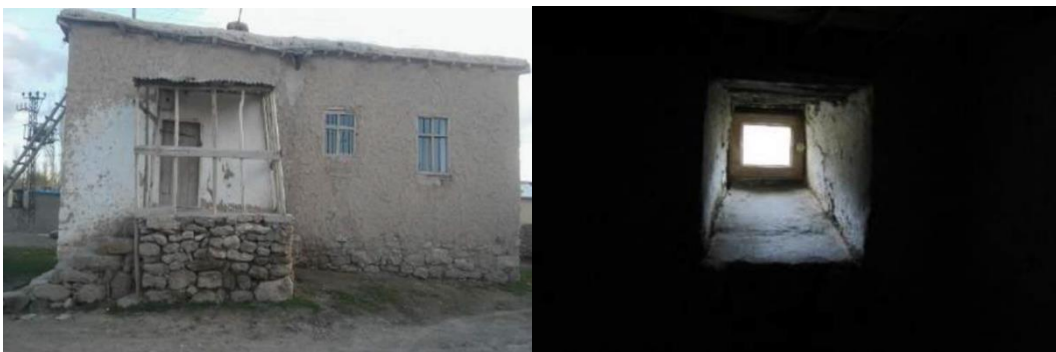


Figure 16: Small sized doors and windows on the facade

Form and Plan Edition

Başkale Rural Houses were planned in an outward-looking manner, just like Van local houses (Subaşı Direk, 2009; Öztürk, 2006). The residences are closely related to nature, even integrated, and built in human dimensions. The spatial organization of the residences, which have a very simple appearance, is formed according to the cultural and economic characteristics of the users and climatic data.

Although the families are crowded, one of the striking details is that in Başkale rural houses, especially the living spaces are not built in very large sizes. Semi-open areas such as balconies

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and terraces are almost non-existent in residences. While the entire house is covered in closed areas, open areas are also quite large due to the fact that it is a rural settlement. As a matter of fact, all places other than residential areas can be considered as natural open space. However, the use of open space varies depending on the season (Figure 17).



Figure 17: Başkale rural houses

Dwellings are generally square, rectangular or L-shaped (Figure 18). When you enter, there is a large sofa and rooms lined up around it. The tandoor is not considered independent of the house, in fact it is the main space of the house. Toilets were generally located outside, and bathrooms were located very close to the tandoor or inside the tandoor house. The barns are mostly adjacent to the house, but their entrances are planned further away from the house entrance. However, in older houses, there are also traces of doors opening from the tandoori house or the sofa to the barn.

is encountered. Thus, it can be said that connections are provided between all spaces without going outside. The number of rooms may vary depending on the size of the family and they have more than one function. The rooms, which are used for living purposes during the day, also have the function of laying down beds at night. In addition, considering tribal meetings and large families, it does not go unnoticed that some rooms are more elaborate and that there is more than one guest room in a residence.

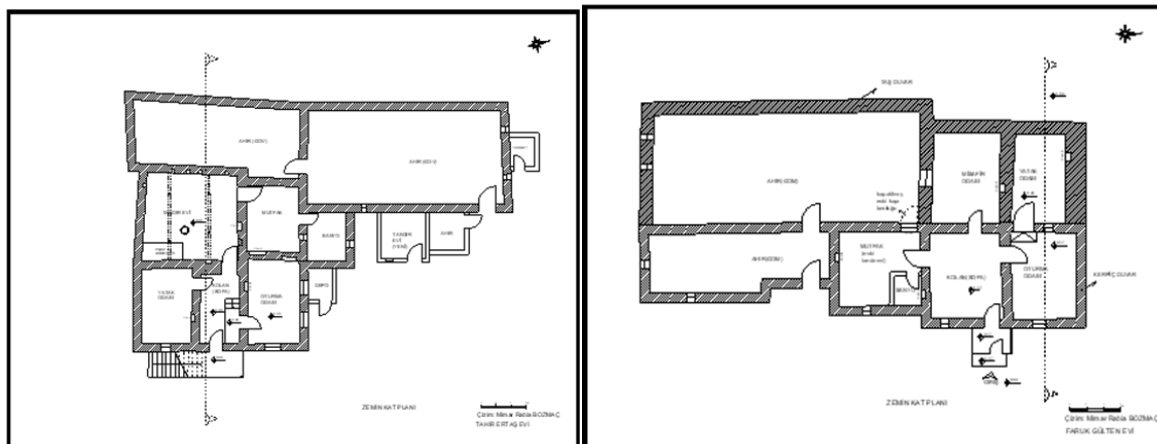


Figure 18: House plans are generally square, rectangular or L-shaped.

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Building Materials

Başkale rural houses were built from building materials that were easy to obtain in the region and local construction techniques were used. Due to the selection of local materials, there is no need for extra transportation and processing. Traditional houses were shaped with the use of adobe, stone and wood, which are easy to obtain in the region. As a result of some processes of the soil, adobe, one of the building materials most compatible with human health, was obtained and used throughout the houses. The straw and other aggregates added are also in the same way. Stone material, which is generally preferred for foundations and spaces such as tandoori houses and barns, is unprocessed and is present in the structure in its natural state (Figure 19).



Figure 19: Başkale rural housing building materials

Wood is the most used building material after adobe and stone. The wood used as the carrier and covering material of the flat soil roofs of the spaces is obtained from trees such as elm and poplar found in the region. Additionally, wood was preferred for door and window joinery (Figure 20). The binding material on the walls is mud. Straw-mixed mud was used in interior and exterior wall plasters. The mud plaster was covered with lime whitewash. The floors are compressed soil and there are also houses that are covered with cement screed over time.



Figure 20. Wood is used in ceiling tiles, door and window openings

Waste Management

The materials used in Başkale rural residences are completely local and natural. In this respect, it is not possible to leave any material waste to nature during the life cycle of the buildings. Additionally, since locally available materials are used, there are no transportation costs.

Since adobe is obtained in natural and residential environments, it is not possible to use it in factories, etc. There is no need for formations that pollute nature. Since the stones used are



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generally rubble, they need to be processed for a long time. It is not the subject. Since the dirty water coming out of houses is generally conveyed to gardens or open pastures, it has gained a natural purification and functionality. The same applies to sewage waste.

4. CONCLUSION and RECOMMENDATIONS

Rural houses are architectural products without an architect and attract attention with their practical functional solutions developed according to the requirements of rural life. As a matter of fact, it is seen that the spatial organization of the houses is affected in line with the data ranging from the livelihood of the user family to the climatic conditions and cultural life of the region. In addition, rural residences that respect the natural environment and give it space are integrated with nature. Considered in this context, it is thought that rural residences will offer different perspectives to today's industrial, ready-made and consuming residential architecture, especially in the context of sustainability.

Başkale Rural Residences have a structure intertwined with nature and have unique qualities. In this respect, it can be said that they are compatible with ecological architecture. The mountainous land structure of Başkale rural settlements was effective in the formation of the plans and forms of the houses. In areas where there is a lot of slope, the buildings are built half buried in the ground and are in harmony with the topography. Construction techniques and material selections were formed under the influence of geographical conditions and climate data, as in other regions of Anatolia. The use of adobe, wood and stone as building materials in the region is at the forefront.

The building materials and rural houses do not constitute any contradiction with the structure of the nature in which they are located, and color, texture, etc. As of now, they provide this. In addition, the rate of leaving non-biodegradable waste is very low compared to today's buildings.

Today, popular building materials and construction techniques are slowly reaching rural settlements. However, abandoning local materials and techniques will have a negative impact on ecological architecture. Materials used in the same way everywhere may not adapt to the structure of the place and the user. When evaluated in this context; It is thought that it is necessary to take some precautions to protect the rural housing texture of Başkale, which is still largely standing. In addition, archiving with documents is also important for the future. Thus, it will be possible to guide new rural residences to be built.

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**A COMPREHENSIVE ANALYSIS OF GENERAL TRENDS IN THESIS
LITERATURE CONCERNING PLACE ATTACHMENT**

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ABSTRACT

The relationship between the physical environment and human beings has been a main subject of environmental psychology research since the 1970s, with various concepts influencing each other. This study aims to examine the literature on place attachment and its relationship to the environment and human interactions. Place attachment is a multidisciplinary concept that centers on the emotional connection between humans and space. The use of this notion has been observed in various design disciplines, including planning, architecture, and interior architecture, all of which are rooted in the fundamental concepts of human interaction, place, and space. This study analyzes existing worldwide theses pertaining to place attachment, aiming to understand the general trend, identify gaps, and discover new areas of production that will contribute to the literature. The research area is limited to the ProQuest Thesis Database. The meta-analysis method was used to analyze the data quantitatively, focusing on the intensity of thesis production in the historical process, design, and related disciplines. The most frequently used concepts related to place attachment were identified through content analysis. The research findings suggest that there has been a notable increase in the creation of theses on the topic of place attachment in the international literature. This increase is particularly evident in the fields of planning, design, and architecture. There is potential for further exploration and expansion of research subjects within attachment research pertaining to place and space, spanning many scales.

Keywords: Place Attachment, Place, Space, Scientific Research, Thesis Production.

1. INTRODUCTION

The concepts of place and space play a significant role in facilitating comprehension of place attachment. The environment in which people reside possesses various characteristics, including geographical, material, temporal, functional, and structural aspects. Additionally, it encompasses gaps and boundaries, engages multiple senses, and holds symbolic significance (Relp, 1976, 1991, 2016; Liu & Freestone, 2016; Williams & Miller; 2021). Place and space contain abstract and concrete meanings, although they are both individual and social. In addition, spatial experience creates the meaning and existence of place. At the same time, it is at the forefront of its social existence as well as its economic existence (Harvey, 1985; Tuan, 1997; Lefebvre, 2014; Cresswell, 2015; Hubbard & Kitchin, 2021).



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Human beings, by nature, have a framework that develops emotional links with their surroundings, owns them, protects them, gives them significance, and connects them. The concept of place attachment refers to the bond between people and place. Place is the physical environment with which people relate emotionally; attachment refers to the effect that occurs between a person and his environment (Low & Altman, 1992). Place attachment is directly related not only to people but also to the society and culture in which people live. The values of the society in which the individual lives and the meanings of the place effect the formation of place attachment (Riley, 1992). Place attachment turns into action as a sense of responsibility that a person feels towards the places or places to which they are attached. This concept, which develops in direct connection with the social structure, emerges with a collective movement in cities (Manzo & Perkins, 2006). Low and Altman (1992), who conducted important research on the concept of place attachment, discussed the concept in the following five categories:

- *Attachments (affect, cognition, and practice)*
- *Places that vary in scale, specificity, and tangibility*
- *Different actors (individuals, groups, and cultures)*
- *Different social relationships (individuals, groups, and cultures)*
- *Temporal aspects (linear, cyclical).*

There are many studies from different disciplines in the literature on place attachment (e.g., Skotols & Shumaker, 1982; Relp, 1976; Riley, 1992; Giuliani, 1991). It is seen that each of these studies was influenced by each other and developed the concept of place attachment, but still no common conclusion could be reached. Scannell & Gifford (2010) paved the way for agreement in the literature with the "place attachment theory" in their study. Place attachment theory consists of three dimensions: person, process, and place. A person includes individual and social meanings. The process examines the emotional, cognitive, and behavioural components of place attachment. Place questions the relationship between the nature of place and attachment by considering the physical and social environment (Scannell & Gifford, 2010).

It is thought that it is important to observe the development of the concept of place attachment in design disciplines in order to understand the relationship of the individual and society with the physical environment. With this in mind, this study aims to understand in which design disciplines the thesis productions on place attachment research have been carried out from the past to the present.

2. MATERIALS and METHODS

This study examines existing international thesis productions on the concept of "place attachment". The aim of the study is to understand the general approach found in the literature, to identify its positive and negative aspects, and to discover new study topics that can contribute to the literature on place attachment. The research area is limited to "The ProQuest Thesis Database". Thesis studies that are not included in ProQuest but are in the universities' own databases are excluded from the scope of the research.

The research was carried out using the meta-analysis method. Research data were analysed quantitatively according to the density of thesis production in design and related disciplines and the density of thesis production in the historical process. However, the most frequently used concepts related to place attachment were identified by content analysis.



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Data was collected in two stages during the research procedure using ProQuest. The initial phase of the study was an examination of the overall number of records registered in ProQuest. Subsequently, this figure was refined to encompass the specific design disciplines falling within the study's defined parameters, namely area planning and development, urban planning, architecture, design, and interior design. Subsequently, the examination of place attachment revealed the identification of concepts pertaining to the environment, society, and the individual. During the second phase, the data underwent a secondary scanning process, wherein ten-year intervals were considered. The research pertaining to place attachment was then assessed based on their respective years of publication.

The initial investigation into the concept of place attachment was conducted throughout the 1970s, as observed in the initial scanning. In light of this rationale, the present study encompasses theses that have been authored on the subject of "place attachment" from the year 1970 forward.

3. FINDINGS and DISCUSSION

As a result of scanning the concept of "place attachment" in the ProQuest database (last updated: September 13, 2023), a total of 5657 results were found. The results obtained in the first stage of the research were narrowed down according to the fields of area planning and development, urban planning, architecture, design, and interior design to which this research is related, and 1071 results were reached. In line with the data obtained as a result of the scanning, Figure 1 shows the thesis production rates for the fields of "area planning and development" (312), "architecture" (366), "urban planning" (550), "design" (207), and "interior design" (21).

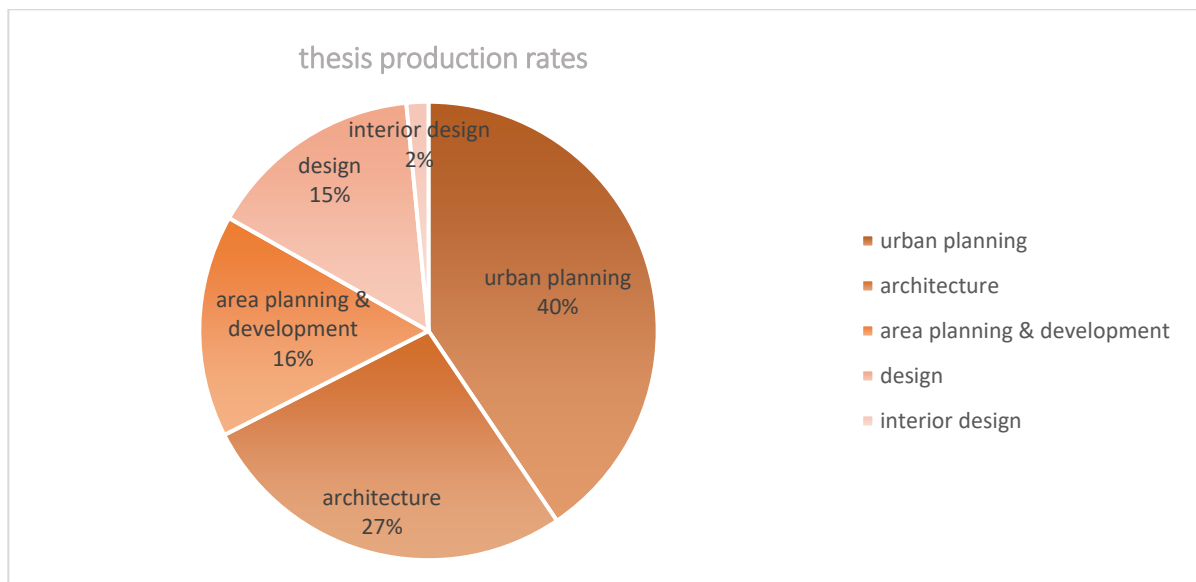


Figure 1. Thesis production rates by field in design disciplines.

When examining the broader scope of topics that theses in design disciplines have explored in relation to the concept of place attachment in regard to the environment, society, and the individual: cities, public spaces, housing, sustainability, climate change, green buildings, economics, culture, education, history, demography, aging, older people, communication, perceptions, privacy, identity, emotions, transportation, community, society, families and family life, and organizational behaviour issues are seen as predominant. When examining the



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research topics, it has been seen that the overarching focus is the physical environment and the associated issues it encompasses. Sociological data pertaining to the overall dynamics of society is investigated, encompassing an examination of the individual and their emotional experiences. Based on the findings derived from this study, it is evident that the research issues under investigation are conducive to scholarly exploration across several domains, employing the framework of place attachment. It has been noted that every subject exhibits an interdisciplinary aspect, including multiple disciplines simultaneously.

During the second phase of the study, an exploration was conducted in the ProQuest database to investigate the concept of "place attachment" within ten-year intervals. Figure 2 illustrates the number of theses generated, encompassing both general and design disciplines, based on the data acquired through scanning. Based on the available data, it has been seen that research pertaining to place attachment experienced a notable rise during the 2000s, with the majority of studies conducted between 2010 and 2019.

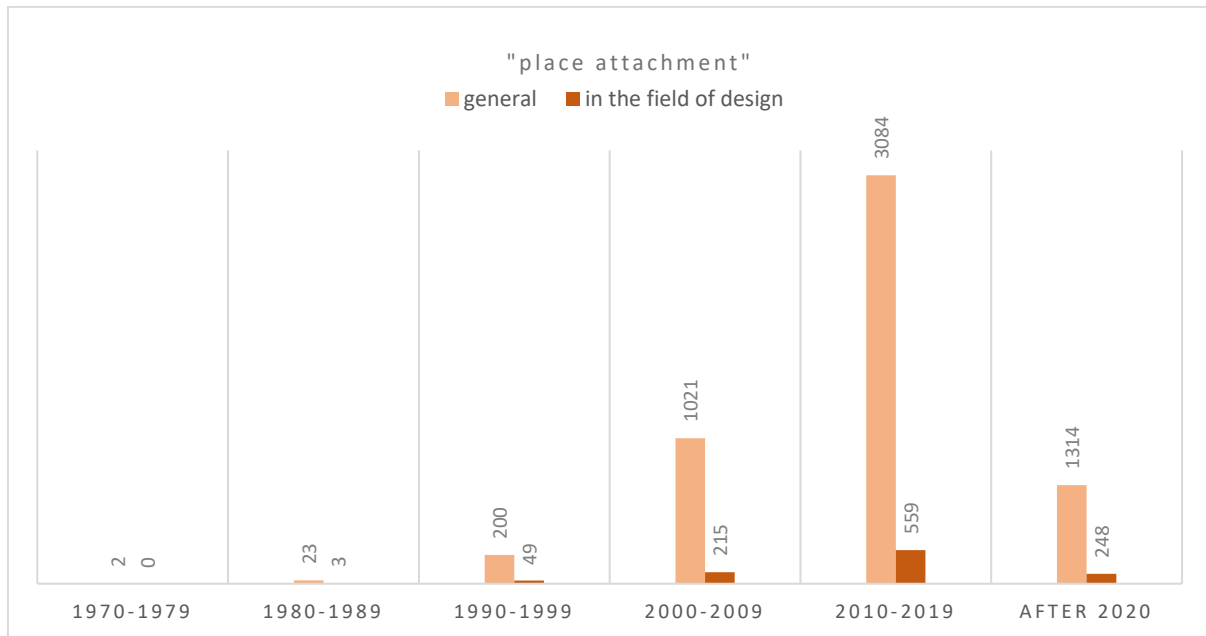


Figure 2. Number of theses produced in general and design disciplines by year.

1970-1979: When the concept of "place attachment" was searched in the ProQuest database between 1970 and 1979, only two results were found. These studies cover psychology fields other than design disciplines. Upon examining the search results, it was observed that no instances of thesis work in the design disciplines throughout the 1970s were identified.

1980-1989: As a result of the screening between 1980 and 1989, 23 theses were found in all fields. The topics related to these 23 thesis studies were examined, and it was seen that there were three studies on the subject heading's "architecture" and "area planning and development" from the design disciplines. The first architectural thesis on the concept of place attachment was published in 1986 (Je, 1986), and the first planning thesis was published in 1987 (Al-Yousef, 1987). There was another thesis study on the intersection of architecture and gerontology in 1989 (Barrick, 1989). These three studies are considered important as they are the first studies in which the concept of place attachment is encountered in design disciplines.



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1990-1999: There was an increase in research focused on the concept of place attachment over the period spanning from 1990 to 1999. Based on the overall screening outcomes, a total of 200 theses were found. Due to the widespread availability of research findings, it has become feasible to categorize the data based on specific fields. The data obtained via scanning was refined based on certain subject categories, namely "area planning & development" (34), "architecture" (19), "urban planning" (9), "design" (2), and "interior design" (2). Consequently, a total of 49 theses have been reached (Figure 3).

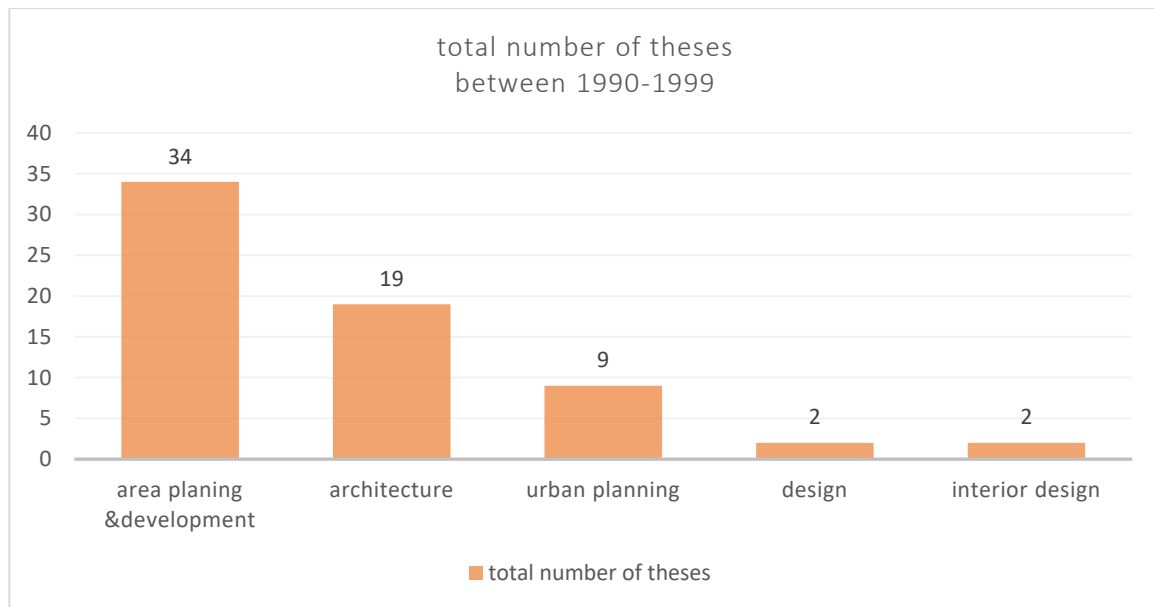


Figure 3. Number of theses by field in design disciplines between 1990-1999.

2000-2009: It has been seen that the production of theses regarding the concept of place attachment continued to increase rapidly between 2000 and 2009. According to the general screening results between these years, 1021 theses were reached. The data obtained via scanning was refined based on certain subject categories, namely "area planning & development" (102), "architecture" (76), "urban planning" (74), "design" (14), "interior design" (11). Consequently, a total of 215 theses have been reached. Accordingly, the quantity of current thesis production has increased in design disciplines in parallel with the general trend (Figure 4).



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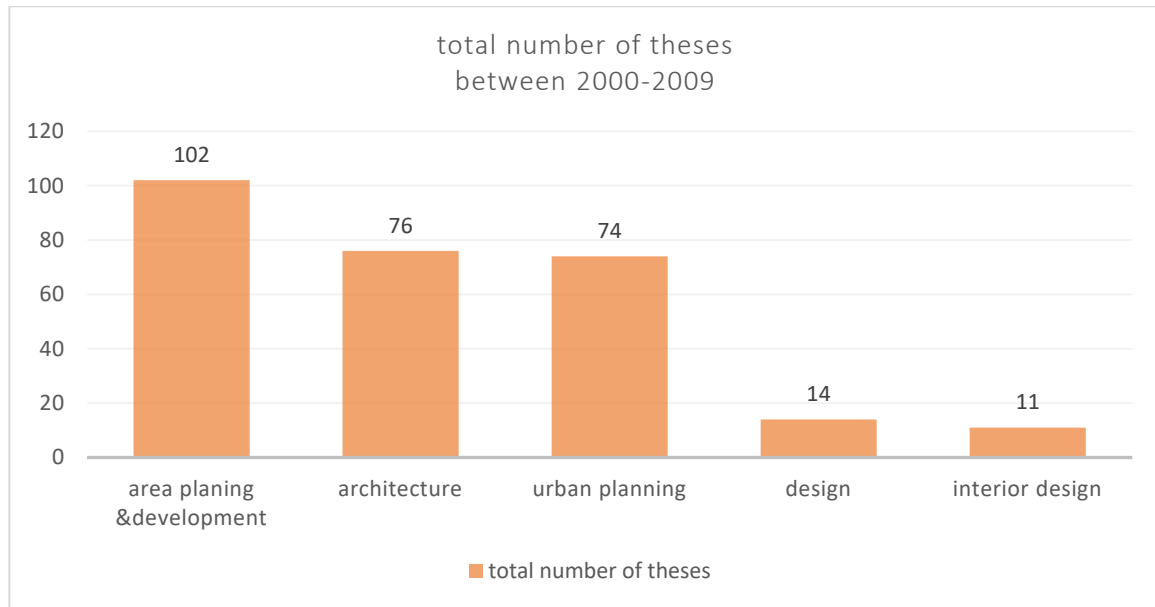


Figure 4. Number of theses by field in design disciplines between 2000-2009.

2010-2019: It was observed that thesis production gained momentum between 2010 and 2019. In this direction, 3084 results were reached. The data obtained via scanning was refined based on certain subject categories, namely “area planning & development” (50), “architecture” (194), “urban planning” (324), “design” (125), “interior design” (7). Consequently, a total of 559 theses have been reached. It has been noted that between these years, there has been a notable increase in the number of thesis productions dedicated to the topic of place attachment, interdisciplinary interaction, and the level of thesis production was increased (Figure 5).

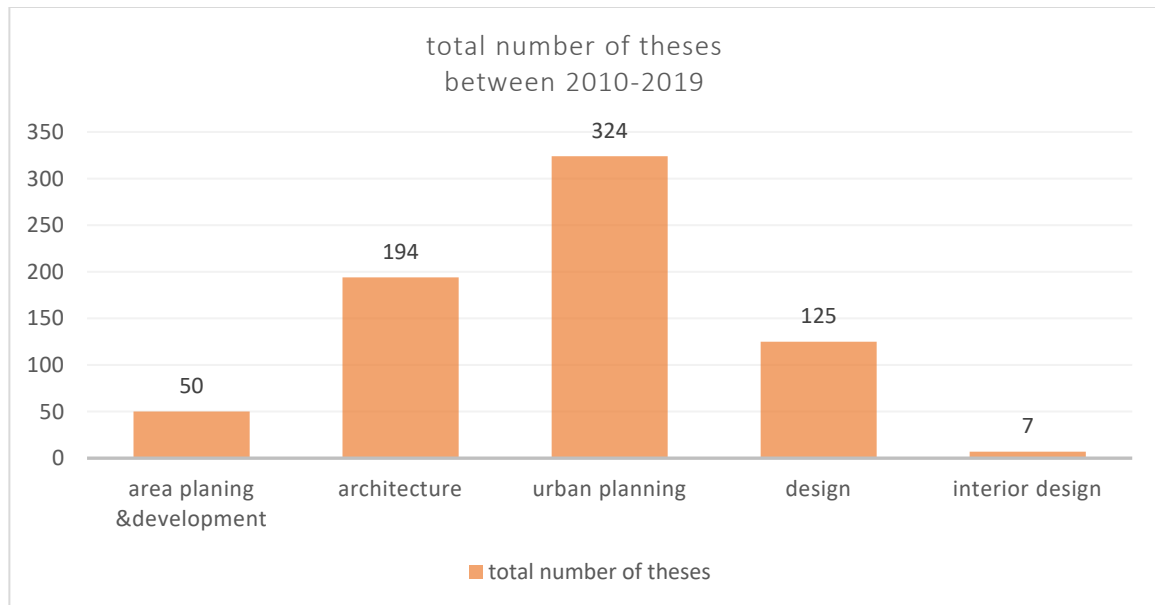


Figure 5. Number of theses by field in design disciplines between 2010-2019.

2020 - 2023 (September): It has been observed that a total of 1314 theses have been produced since 2020. The data obtained via scanning was refined based on certain subject categories,



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namely “area planning & development” (25), “architecture” (75), “urban planning” (143), “design” (66), “interior design” (0). Consequently, a total of 248 theses have been reached (Figure 6). Based on the findings derived from the data collected in last three years, there is a projected anticipation of progressive and sustained growth in theses production that will persist until the culmination of the present decade.

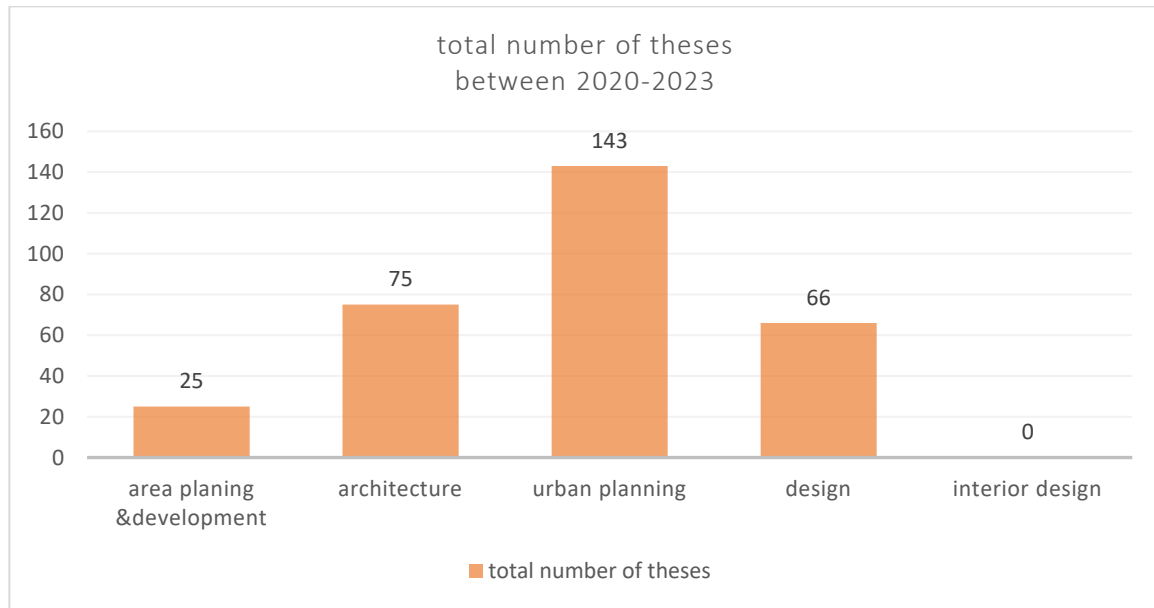


Figure 6. Number of theses by field in design disciplines between 2020-2023.

In light of all these evaluations, when we look at the density of theses produced on the concept of place attachment since the 1970s, it can be seen that there has been similar progress in the fields of architecture and planning. Looking at the decade-long intervals, interest in the concept of place attachment has gradually increased. It can be said that the simultaneous acceleration of production in all disciplines in 2010 and onwards is an indication that the interdisciplinary relationship has strengthened the concept. It has been concluded that, among the design disciplines, the field of interior architecture is the field where thesis production is least carried out.

This study has some limitations arising from the research environment. The first of these is that the ProQuest database is open to uploading data at any time; therefore, the numbers obtained may change every day. In this regard, it would be appropriate to state that the data collection process in the research was constantly updated between August 2023 and September 2023 (last edited: September 13, 2023). Another situation is that the subject limitation cannot be made according to a standard when narrowing down the results. The reason for this is that it is unclear which topics those who uploaded their thesis limited their topics to. While the number of theses is given in this section, the number of theses on which subject is stated in parentheses, but some studies cover more than one discipline. For this reason, the number of theses produced by the field does not match the total number obtained.

4. CONCLUSION and RECOMMENDATIONS

In this research, existing theses registered in the ProQuest database regarding the concept of place attachment were examined in order to guide new scientific research. A total of 5657



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results were obtained covering the period between 1970 and 2023, and 1071 of them were found to belong to design and related disciplines. According to the research findings, the fact that most of these studies are in the field of “urban and regional planning” shows that the concept of place attachment has been mostly researched on large scales to date. “Architecture” is the discipline with the next highest production. In the field of “interior architecture”, thesis production is quite low compared to other design disciplines. In light of these data, it can be seen that the number of theses produced decreases as the scale of the research area decreases.

When we look at the literature, we see that the concepts of space, place, and place attachment are being researched even today in many different disciplines. With reference to this, it can be said that the development of thesis productions through interdisciplinary interaction can contribute positively. It would be beneficial for new scientific research to be conducted in this direction to cover a wide range from large scales (urban, environment, etc.) to smaller scales (interior spaces). At this point, issues related to the environment, society, and the individual, to which the concept of place attachment is more related, can be diversified, and the data obtained can be enriched. Diversifying the scales of research areas may enable the correlation of data in the literature from the urban scale to the spatial scale.

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INVESTIGATION OF DECISION-MAKING METHODS FOR ENERGY EFFICIENCY IN THE EARLY DESIGN PHASE OF BUILDINGS

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ABSTRACT

In the early 21st century, global awareness regarding non-renewable resource consumption, global warming, and climate change began to grow. The Paris Agreement prompted countries to create action plans, targeting global improvements in energy use and carbon emissions by 2050, with a focus on various sectors, including building construction. Buildings currently contribute around 35% to global energy consumption and carbon emissions, making it imperative to explore strategies for reduced consumption and emissions. Architects play a pivotal role in shaping building design and energy efficiency. Making informed decisions during the initial design phase is critical, and architects often employ simulation programs to predict a building's energy consumption. However, not all architects are proficient in these tools, and they can sometimes be limited in providing comprehensive solutions, prolonging the design and construction process. To bridge these gaps, the idea of offering architects literature-based support tools for decision-making has emerged. To this end, a literature review was conducted, focusing on energy-efficient decision-making methods in the early design stages. This study examined national and international master's and doctoral theses, aiming to enhance knowledge in this area and develop a roadmap for creating effective decision-making systems for energy-efficient building design.

Keywords: Energy-efficient Buildings Design, Early Design Phase, Decision-Making Methods.

1. INTRODUCTION

'Energy' is a fundamental concept in both physics and everyday life, its capacity to perform work being essential. It exists in numerous forms and is integral to many of our daily activities, including powering our homes, aiding in transportation, and enabling our bodies to function. Energy can be obtained from two different types of sources: renewable (e.g., solar, wind, hydroelectric, geothermal and biomass) and non-renewable (e.g., coal, oil, and natural gas, and nuclear). Renewable energy sources can be naturally renewed, and their environmental impact is minimal. They are sustainable and produce little or no greenhouse gas emissions. On the other hand, non-renewable energy sources are finite and deplete as they're used. They are associated with pollution and contribute to climate change (Energy Information Administration, 2023).



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Issues regarding pollution, energy consumption and global warming began with the Industrial Revolution in about 1760, but officially came onto the agenda after the 1900s. The meetings at which energy issues were discussed are listed chronologically in Figure 1. The Paris Agreement signed in 2015, one of the most important milestones in the process that began with the UN Conference in Stockholm (1972), proposed to limit global warming to a maximum of 2°C. At the Intergovernmental Panel on Climate Change held after the Paris Agreement, it was decided that this limit should be reduced from 2°C to 1,5°C. In addition, reducing carbon emissions by 45% in 2030 compared to 2010 and zeroing carbon emissions in 2050 have been brought to the agenda. As a result, important strategies have been developed for many sectors such as agriculture, transport, industry, and construction. Ultimately, it has been emphasized that the use of fossil fuels should be reduced/eliminated, and the use of fully renewable resources should be started (International Energy Agency, 2021; Kabbej Sofia, 2017).

Meanwhile, the Energy Efficiency Law, which is the basis for most of the energy efficiency practices implemented in Türkiye today, has been published. The purpose of this law is to increase efficiency in the use of energy resources and use energy effectively, prevent its waste, reduce the burden of energy costs on the economy and protect the environment. Subsequently, the Regulation on Energy Performance in Buildings (published in 2008) regulates the procedures and principles for the effective and efficient use of energy and energy resources in buildings, the prevention of energy waste and the protection of the environment. With the signing of the Paris Agreement in Turkey in 2021, the Green Deal Action Plan was published, the Energy Performance Methodology in Buildings was updated in 2022 and the nearly-Zero Energy Buildings Guidebook was published (T.C. Çevre ve Şehircilik Bakanlığı, 2020; T.C. Ticaret Bakanlığı, 2021).

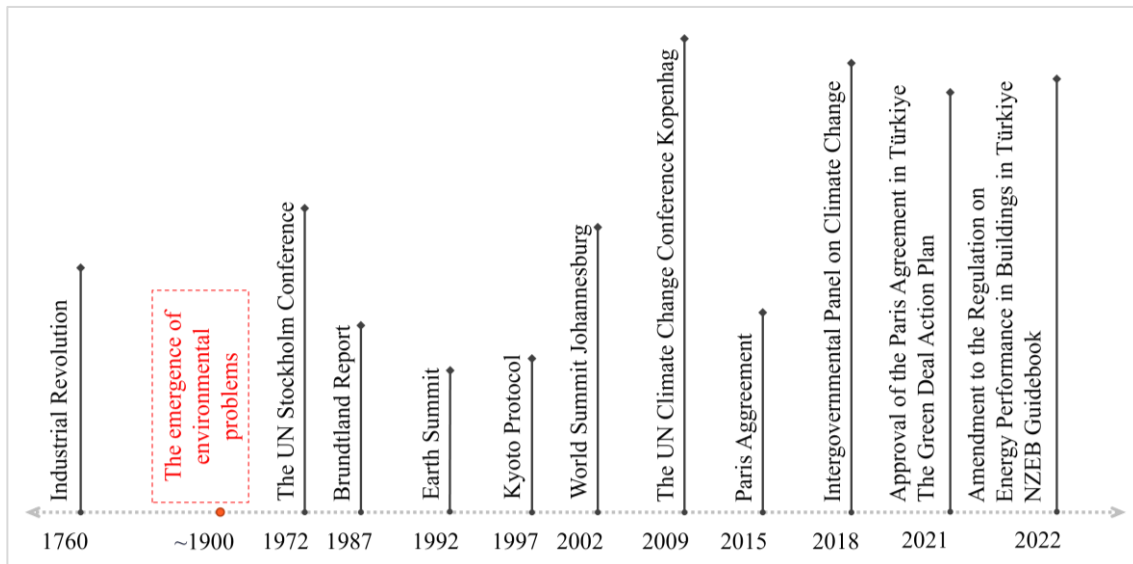


Figure 1. Chronological order of events related to energy efficiency and savings

Furthermore, the annual report issued by the Global Alliance for Buildings and Construction, an international voluntary organization endorsed by the UN Environment Programme in alignment with the Paris Agreement, serves as a comprehensive overview of the building construction industry's achievements in the preceding year. According to the report, the share



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of building activities in global energy consumption has increased over the last 3 years to 35-36 and 34 percent respectively, while carbon emissions are 38-37-37 percent (as seen in Figure 2).

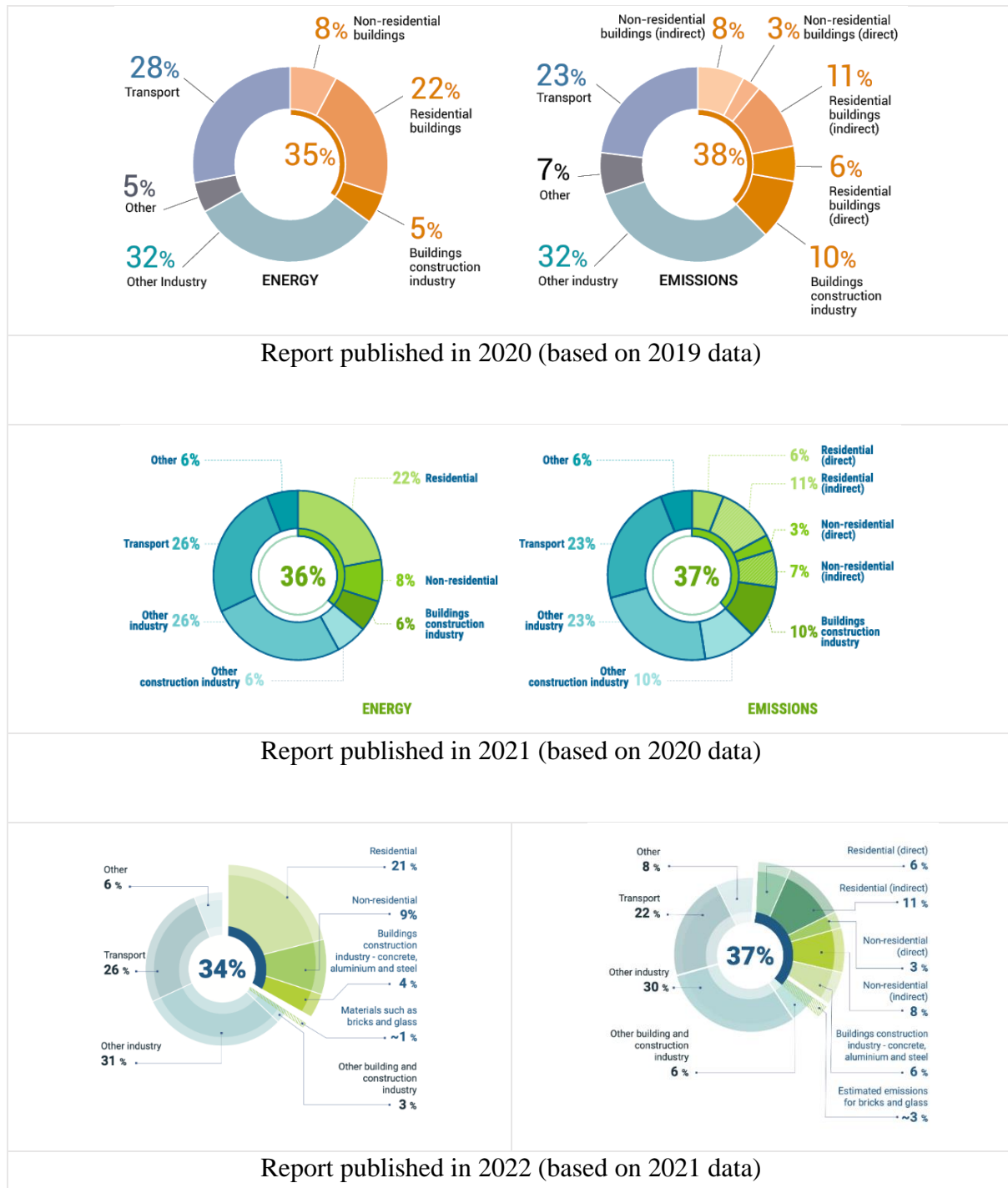


Figure 2. Share of buildings and construction activities in total global energy consumption (left) and share in total CO₂ emissions (right) (The Global Alliance for Buildings and Construction, 2022)



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In other words, construction activities have a significant 1/3 share of global energy consumption and carbon emissions. According to the 2022 report, the building and construction sector is not making sufficient progress towards the 2050 zero carbon target. Economic crises, energy vulnerabilities, security and climate crises are hampering the progress needed to increase resilience and decarbonize the global building sector (e.g., Covid-19 pandemic) (*The Global Alliance for Buildings and Construction*, 2022). Further progress is needed to ensure the global adoption of mandatory building energy codes and to move existing codes towards zero emissions. Governments are increasing their levels of investment in energy efficiency, in line with the levels required to meet the Paris Agreement targets. The global building industry must work with all stakeholders to decarbonize by 2050.

2. Energy Efficiency Regarding Architecture Discipline

Energy efficiency is the sustainable use of less energy to carry out a particular task and produce a desired outcome. It measures how effectively energy is utilized in a given process or system, with the aim of reducing energy wastage and curbing energy consumption, while simultaneously enhancing performance and output. Efforts to improve energy efficiency often include the development and deployment of energy-efficient technologies, the adoption of energy efficiency standards and regulations, and public awareness campaigns to encourage energy-saving behavior. Together, these measures contribute to a more sustainable and responsible use of energy resources.

a. Energy efficiency in buildings and its criteria

Energy efficiency in a building means minimizing the amount and cost of energy inputs for individual and social benefit, from birth to death (cradle to grave), including the design, construction, operation, maintenance-repair and demolition stages of the building. An energy efficient building provides thermal (climatic), visual and acoustic comfort conditions by providing maximum benefit from natural resources while consuming minimum energy (Dikmen, 2011). Accordingly, it is appropriate to consider the following criteria for an energy-efficient approach in buildings (Çevre ve Şehircilik Bakanlığı, 2011):

- Field (land) evaluations (*including site selection, building layout/orientation, creation of building geometry, making spatial organization and effective use of energy resources like renewable or conventional sources*)
- Building plan (*including compact layout, interiors, mechanical volumes, ventilation systems, configuration of building shell, windows and minimization of shading in winter*)
- Building energy performance calculation (*involving building purpose, local climate data, heated area and heated building volume, comfort conditions, building shell details, windows, exterior doors, ventilation rate and heat recovery efficiency*)
- Building Shell
- Ventilation Systems
- Mechanical Installation
- Construction-Quality Control and Certification
- Information for Landlords and Tenants

b. Decision-making in architecture

In this context, architects, and engineers, who are the stakeholders of building production activities, are the decision-making mechanisms in building design. Improving a building's energy performance and sustainability needs to start at the design stage, as the potential for optimization is greater in the early stages of a project and the impact of changes on building and construction costs is lower (Figure 3). Accordingly, making the right decisions at the early design stage to ensure energy efficiency in buildings can prevent problems that may occur later and is important in reducing energy consumption and carbon emissions (Bragança et al., 2014).

There are studies in the literature on the energy consumption of building elements and materials. With the information contained in these studies, architects and engineers can have an idea of the energy consumption of the structure they are designing by using various simulation/modeling programs during the design phase. However, because not all architects are skilled in the use of such software tools, and because these programs may lack the capacity for comprehensive decision making, or because of their potential to extend design and construction timescales, certain decisions are sometimes made hastily and based on traditional knowledge. As a result, as with the existing building stock, the energy efficiency of newly constructed buildings will not be achieved to the required level, which will delay the achievement of the Paris Agreement targets on a national and international scale.

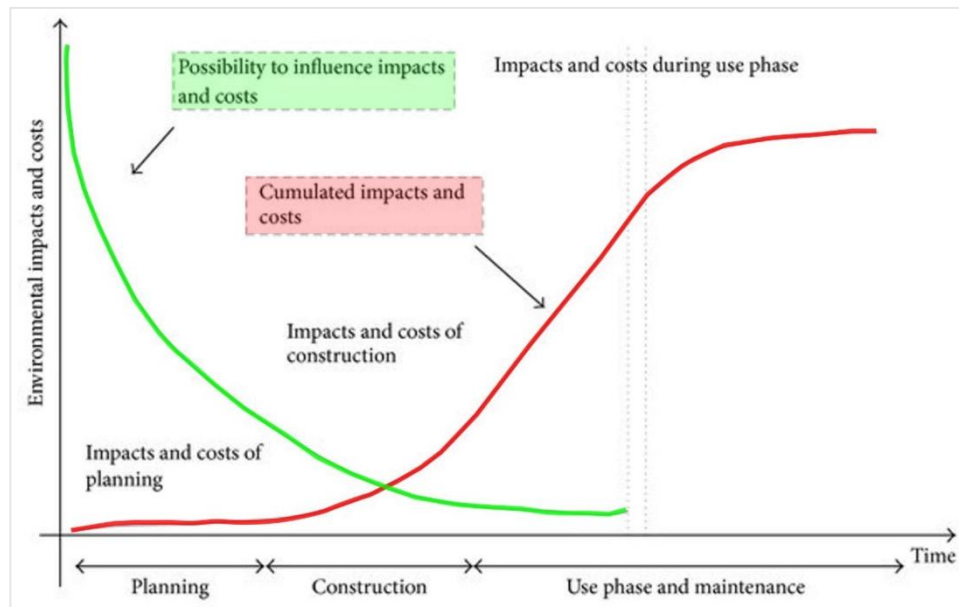


Figure 3. The relation between construction phase vs environmental impacts and costs (Bragança et al., 2014)

3. MATERIALS and METHODS

As explained above, the information in the literature on energy efficiency should be integrated into the design with a decision-making support tool at the early design stage. In this context, this study aims to investigate firstly the energy efficiency parameters in buildings and then the published master's and doctoral theses on tools that will help decision-making at the early design stage in the field of architecture. Thus, it aims to increase the level of knowledge on the subject.



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For this purpose, master's and doctoral theses were scanned using the ProQuest (international) and National Thesis Center (Turkey) databases under the keywords 'energy', 'energy-efficiency' and 'decision-making'. By examining the theses in their context of purpose, material, methodology, results, and suggestions, it is aimed to create a working model for a decision support model for energy efficiency at the early design stage in architecture. Two master's and three doctoral theses containing the words energy and decision in their titles were examined and are given in Table 1. Then, the aims, materials, methodologies, results and developed recommendations of these theses are given in Section 3.

Table 1. List of references reviewed

Title	Year	Type	Ref. No.
A methodology for energy optimization of buildings considering simultaneously building envelope HVAC and renewable system parameters (<i>Binalarda yapı kabuğu, mekanik sistemler ve yenilenebilir enerji sistemleri parametrelerinin eş zamanlı enerji optimizasyonu için bir yöntem</i>)	2015	PhD	R1
Energy and environmental performance-based decision support process for early design stage of residential buildings (<i>Konut yapılarının erken tasarım aşaması için enerji ve çevresel performansa dayalı karar destek süreci</i>)	2016	MSc	R2
The influence of early design decisions on energy demand: A quantitative assessment using sensitivity analysis (<i>Ön tasarım aşaması kararlarının enerji kullanımı üzerine etkisi: Duyarlılık analizi ile kantitatif değerlendirme</i>)	2018	MSc	R3
Suggestion for a decision support system to reduce cooling loads on transparent facades (<i>Saydam cephelerde enerji yükünün azaltulmasına yönelik bir karar destek sistemi önerisi</i>)	2021	PhD	R4
Simulation? Machine Learning? Simulation X Machine Learning?: A decision system for research integrating building physic simulation and machine learning methods in the early design stage	2023	PhD	R5

4. FINDINGS and DISCUSSION

4.1. Review of existing literature

Bayraktar (2015) aimed to create an optimization algorithm that will enable the computational design of buildings that reduce CO₂ emissions during building use, ensure energy efficiency, and also address the consumption of HVAC systems and renewable energy technologies. The study was carried out on office type buildings for heating and cooling periods in the moderately humid Istanbul, semi-arid Ankara, and hot Antalya climates. First, parameters and data for energy efficiency were collected, and then simulations for energy efficiency were made using DesignBuilder and EnergyPlus (DB plug-in). Sensitivity analysis of the data was also performed using empirical methods and the results were optimized with MATLAB, GenOpt and modeFRONTIER. Using the proposed methodology can provide climate-appropriate design recommendations, which results in cost reductions and energy savings (Istanbul-moderate humid -energy 44%, CO₂ 49%, cost 21.7%; Ankara-semi-arid -energy 47.3%, CO₂ 50.4%, cost 23.3%; Antalya-hot humid -energy 57.5%, CO₂ 60.3%, cost 30.4%). Similarly, the thermal comfort of building occupants has been increased with new design suggestions. While



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creating design alternatives, choosing products available on the market will make it easier if the system is used by architects/engineers working in the market. The design parameters examined were kept within the range allowed by the EnergyPlus program. Design parameters can be diversified with different parameters such as building form, shading element, construction area design. In this study, energy consumption was only considered in the usage phase (operational energy), while embodied energy was not taken into account. The study can be enhanced by adopting a cradle-to-grave approach. Optimization methods can be further refined (Bayraktar, 2015).

Gerçek (2019) aims to test the usability of a decision support process that analyses parameters related to heating, cooling, annual energy consumption, and carbon dioxide emissions during the early stages of residential building design. The study was carried out on residential buildings for heating and cooling periods in the hot humid İzmir climate. Gerçek identified key parameters by conducting sensitivity analysis with SimLab after collecting data. Energy-efficient alternatives were presented through energy simulation with DesignBuilder and EnergyPlus. Matlab, Microsoft Excel, and Autocad were utilized to assess the efficacy of the developed system through surveys and interviews. The study revealed that the parameters that most affect annual energy consumption and operational carbon emissions are the U value of windows and solar heat gain coefficient (SHGC). This tool, which helps experts involved in building production activities to use building performance simulation tools, has been shown to increase building quality at the early design stage. This tool has been shown to save time by reducing trial/error time. It is emphasized that the results obtained in the study can provide building professionals with greater awareness about the importance of a systematic design decision approach in the early design process and that it is possible to apply similar processes at different design stages and in various building types. Diversification of uncertainty and sensitivity analyses, increasing diversity by integrating building elements not included in simulation systems into the system, inclusion of embodied carbon calculations in future studies, and increasing the number of experts interviewed and the number of structures examined within the scope of the study are stated as aspects of the study that can be improved (Gerçek, 2016).

İşeri (2018) aimed to determine the importance of parameters to ensure energy efficiency in office buildings during the heating and cooling period at the early design stage in two different climate zones (Erzurum/Turkey - cold climate, Izmir/Turkey - hot and humid climate). After collecting data on energy efficiency, important parameters were determined with Python-Salib and Morris sensitivity analysis and energy efficient alternatives were presented with Design Builder and EnergyPlus energy simulation. As a result of the sensitivity analysis, it was revealed that the parameters of the building envelope (facade width, window-wall ratio, u-value of the roof) are more effective for Erzurum, which has a cold climate. It was observed that the results were similar in Izmir, which has a hot climate, but the distribution was more regular and the parameters related to solar gain also gained importance. In the study, evaluation of parameters for more than one climate type, the necessity of obtaining climate-related data from the most up-to-date sources, detailing the study of different building types, applying different sensitivity analyzes such as Monte Carlo to filter the parameters, and eliminating some deficiencies experienced while producing the energy model were stated as aspects to be improved (İşeri, 2018).

Ersan (2021) aimed to identify effective design strategies and develop a design support system that determines the impact levels of the identified strategies in order to reduce the increasing



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cooling load in the hot period in the moderately humid Istanbul climate in high-rise buildings with transparent facades. After data collection and optimization, field studies, DesignBuilder and EnergyPlus simulations were carried out. The effect of many parameters on the cooling load, such as the average heat transmission coefficient of the window (u), Solar heat gain coefficient (SHGC), coolness index, sealing level of the window, climate, orientation, building form, glass selection and shading, has been discussed with a holistic approach. The lowest cooling energy requirement is the 17th scenario (6 mm low-e glass to the left in the outer glass, 12 mm argon gas in the 1st space, 6 mm flat glass (colorless) in the middle glass, 12 mm Argon gas in the 2nd space, 6 mm in the inner glass low-e glass + blinds) was recorded. In this scenario, the proposed passive cooling techniques provided maximum improvement in thermal comfort for the hot period. It has been proven that the decision support system presented in the study can provide accurate guidance to designers in their decision-making processes from the first design stage. It is a positive contribution that the developed system can be modified to meet other performance criteria. It has been stated that the study can be improved by detailing the study on different climate types and building functions, including passive strategies as well as active renewable energy technologies, and by providing guidance in the design of different building elements/components instead of transparent facades (Ersan, 2021).

Xu (2023) presented the inputs and outputs of a machine learning system covering two distinct areas: daylight illumination and pedestrian comfort analysis under windy conditions. To evaluate the effectiveness of these systems during the initial design phase, tests were conducted. Simulation and machine learning have been defined and the situations in which they are required have been determined. Data was entered with machine learning methods for various case studies and the results were evaluated. Software such as Rhino, Grasshopper, Climate Studio, HoneyBee, LadyBug, Eddy3D, Machine Learning models (ANN, cGAN), Phyton were used. Numerous techniques detailing individual simulation programs and machine learning models are featured in various literature. This dissertation offers a generalized, abstract roadmap for researchers to utilize in upcoming studies. The conducted case studies exemplify the incorporation of a framework for the development of physics-based simulation and machine learning integrated tools. As a weakness in the study, the machine learning model might not always create a reliable prediction. Even if this level of accuracy increases, there must be a human impact in the process (Xu, 2023).

In the five theses reviewed, a variety of system proposals were formulated for decision-making during the early design stages of buildings in different climate zones and heating periods. These proposals incorporated different methods and parameters along with various simulation programs and software. Furthermore, they were designed to accommodate diverse building types (Table 2). The majority of the theses explored both heating and cooling periods, with particular emphasis on office buildings. In certain theses, the chosen parameters were compared through sensitivity and uncertainty analyses with the assistance of programs like SimLAB, Grasshopper, and Python-Salib. The majority of theses utilized a range of simulation and optimization programs, with DesignBuilder and EnergyPlus simulation program plug-in and Rhinoceros Grasshopper parametric modeling and analysis programs being the most commonly used. In addition, it has been observed that certain building physics parameters can be assessed utilizing machine learning (ANN, cGAN) along with simulation software.

The parameters, building types, and climate types examined in most theses are typically limited. Moreover, the studies fail to account for embodied energy consumption, and the proposed



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systems are not adequately visualized and presented in a user-friendly database. Additionally, the studies often exclude parameters related to renewable energy consumption. Diversifying sensitivity and uncertainty analyses in these studies is also possible. There is also potential for employing artificial intelligence and machine learning technology in a system designed to assess parameters of energy efficiency.

Table 2. Analysis of references reviewed

Analysis	R1	R2	R3	R4	R5
Type	MSc	PhD	MSc	PhD	PhD
Year	2015	2016	2018	2021	2023
Building type	Office	Residential	Office	Office	-
Climate type	+ (3)	+ (1)	+ (2)	+ (1)	-
Term	Heating+cooling	Heating+cooling	Heating+cooling	Cooling	-
Sensitivity an.	+	+	+	+	-
Softwares	DesignBuilder EnergyPlus GenOpt MATLAB modeFRONTIER	CCWeatherGen SimLab DesignBuilder EnergyPlus Matlab Microsoft Excel Autocad	DesignBuilder EnergyPlus Python Eppy&Geomeppy Salib&Morris	DesignBuilder EnergyPlus	Rhino-Grasshopper Climate Studio HoneyBee LadyBug Eddy3D Machine Learning (ANN, cGAN...) Phyton

4.2. Energy Efficient Decision-Making Support Model Proposal

According to the theses examined, a decision support model that can support architects and engineers who play the decision-making role in building construction activities, which have a significant share in energy consumption, in making energy efficient design decisions to benefit on a global scale in preventing climate change and reducing global warming, can be produced with the organization diagram given above in Figure 4. The studies to be carried out in this context are aimed to provide added value in solving energy-related problems.

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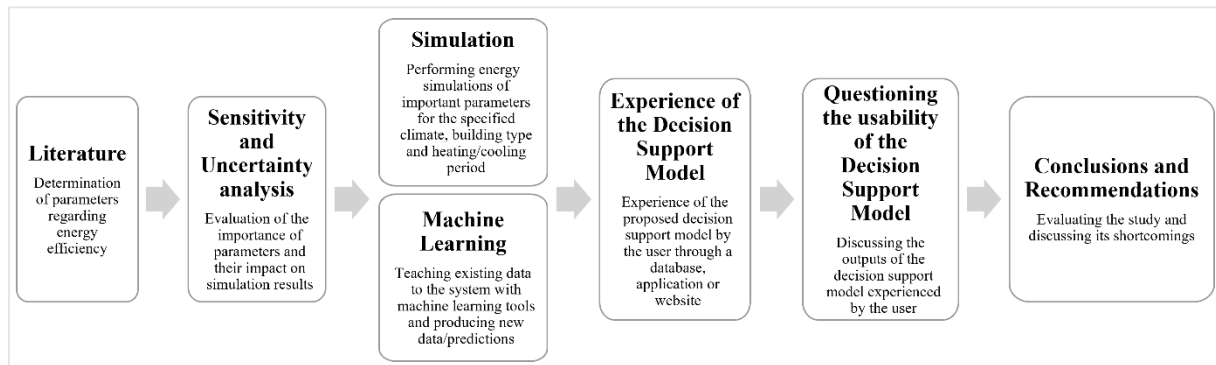


Figure 4. Organization diagram proposal for decision support model generation to ensure energy efficiency in early design stage

5. CONCLUSION and RECOMMENDATIONS

This study focuses on the efficient use of energy, which is an indispensable part of our daily lives and is necessary to perform all vital activities. In this context, buildings and building construction activities, which are responsible for 1/3 of global energy consumption, need to be made energy efficient. The Paris Agreement targets signed in 2015 also support this situation.

Architects and engineers, who play a decision-making role in building production activities, need to combine the information about energy efficiency in the literature with various simulation programs and make holistic decisions.

In order to produce a decision support tool that can help with this, theses written on this subject have been examined and presented in Section 3. The aims, materials, methodologies, results and suggestions of the theses examined were revealed and the missing aspects in the literature were stated. As a result, it is thought that a model can be produced with the decision support tool organization chart presented in Figure 4. It is aimed that this study will provide a basis for future studies.

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**SITE PLAN OF THE BURSA MEVLEVÎHÂNE ASITÂNE DURING ITS LAST
FUNCTIONING HISTORICAL PERIOD**

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ABSTRACT

Founded on the teachings of Mevlâna Jalaluddin Rumi (1207-1273), the sufi order of Mevlevî dervishes existed for over 600 years. It spread from its centre in Konya by establishing Mevlevî dervish lodges called mevlevîhânes, which were divided into the two categories of asitânes and zaviyes according to their function and capacity. Asitânes were larger architectural complexes administrated by a shaykh and teaching staff of dervishes called dedes where dervishes could undergo a 1001 day of spiritual training, whereas zaviyes were smaller mevlevîhânes without this capacity and training programme. On the closure of all the dervish lodges in 1925, there were almost 200 mevlevîhânes and 14 asitânes in existence. This study focuses on the architectural site plan changes within the complex of the Bursa Mevlevîhâne Asitâne during the 19th century. By examining its rich supply of historical maps, archival plans and photographs, it is possible to trace the locations of units such as stables, gasilhâne, main kitchen, toilets, laundry-drying gardens etc. which are almost unknown in other mevlevîhânes. It is hoped that this study will also contribute to the documentation of the original data of the structures and layout of the site plan of Bursa's last functioning mevlevîhâne in 1925, so that a correct restitution and reconstruction of the complex can be made possible.

Keywords: Bursa Mevlevîhâne Asitâne, Asitâne, Mevlevîhâne Architecture.

1. INTRODUCTION

Due to its geographical location, Bursa became the first capital of the Ottoman Empire and the intersection of many civilizations and cultures. All the civilizations that occupied Bursa increased the value of the city which has many monumental and civilian architectural structures. The Bursa Mevlevîhâne Asitâne is one of these structures. Based on the teachings of Mevlâna Jalaluddin Rumi, the Mevlevî sufi order, was established in Konya in the late 13th century and spread throughout the Ottoman Empire. Smaller mevlevîhânes were called zawiya, while the larger ones equipped to provide the 1001 day of spirutal training were called *asitânes*. An asitâne was a building complex that included all the sections for the functions of worship, education, accommodation, nutrition, cleaning and visitation (Tanrıkorur, 2004, 468-471). Sometimes a structure within the complex was used for more than one function.

An asitâne built on a large plot of land, had a *semahâne*, a large assembly hall where the ritual ceremony of sema (whirling movements) called *Mevlevî Ayini Sherif* were held; a *meydan-ı sherif* where the meetings of the administrative staff were made after the morning prayer and important decisions were made; a *türbe-i sherif*, tomb area where the founding shaykhs were



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buried; a *hamusan* (the graveyard of the silent ones) where dervishes and members of the mevlvihane were buried. As in residential architecture, accommodation units were divided into two main groups, *harem* quarters for the shaykh's family and female dervishes and *selamlık* quarters for male dervishes. The shaykh and his family lived in the harem quarters and female dervishes were given lessons there. The selamlık quarters was where male guests were hosted and male dervishes held meetings and practised music. In addition there was a row of cells for the *dedes*, those senior dervishes who had completed their 1001 days of spirital training and who had achieved the rank of "dede". One of the most important sections of an asitane (which was not found in a zaviye) was its *matbah-ı sherif* section which was designated solely to the 1001 day of training and housing of new initiates called *çilekeş canlar*. On the other hand, there existed a separate main kitchen, where a *somathane* (dining room), cellars, bakery and other facilities for daily food and beverage needs of the mevlvihâne were met. In mevlvihanes, there were other elements such as a *hamam* (bathing areas), a *gasilhane* (for preparing the dead for burial), places for making ablutions ranging from simple taps to fountains, cisterns, wells and pools for water needs could be found (Tanrıkorur, 2000, 89-101). Since transportation was mostly by horse and donkey stables were available as well as boathouses in mevlvihânes located by the sea (Tanman, 2013, 51-52).

The Bursa Mevlvihâne asitâne is one of the 14 asitânes (Afyonkarahisar, Bursa, Eskişehir, Gelibolu, Aleppo, Cairo, Kastamonu, Kütahya, Manisa and Yenişehir and four –Galata, Yenikapı, Beşiktaş, Bahariye, Kasımpaşa- in İstanbul) which were built during the Ottoman period (Tanman, 1991, 487).

This study focuses on the site plan of Bursa's last functioning mevlvihâne before its closure in 1925. Firstly, in the short historical introduction the founding, location of the geographical area of the Bursa Mevlvihâne Asitâne will be explained. Secondly, with the available source data, the historical process involving the changes (expansion, reconstruction, repair) to the Mevlvihâne up until 1925, when its functioning as a dervish lodge ended, will be discussed using maps, site plans and photographs. Next, the changes between 1925 to 1953, when the demolition process of the mevlvihane began, will be explained. Finally, all these sources will be evaluated and after bringing the site plans, maps and drawings all to the same scale and superimposing them one over each other, a site plan for the year 1925, when the Mevlvihâne was last functioning, will be drawn and interpreted.

2. The Bursa Mevlvihâne Asitâne

The Bursa Mevlvihâne Asitâne was built by Shaykh Ahmet Cünunî Dede in the Veziri neighborhood of the Pınarbaşı district in 1615, during the reign of Sultan Abdulhamid I, who gave great support to the Mevlvî order. There is no detailed information about the first building of the Mevlvî lodge, but some information about the sections of the building can be obtained from its foundation charters. It consisted of three pir houses, two ovens, a garden with various trees and five wells. In addition, a semahâne, similar to a heavenly mansion was built in the garden. The wall between the donated houses was demolished and the other outbuildings of the mevlvihane were constructed¹ (Figure 1).

¹ Bursa Mevlvihânesi Vakfıyesi, Süleymaniye Kütüphânesi, Lala İsmail Paşa, no: 737, s. 84-85.

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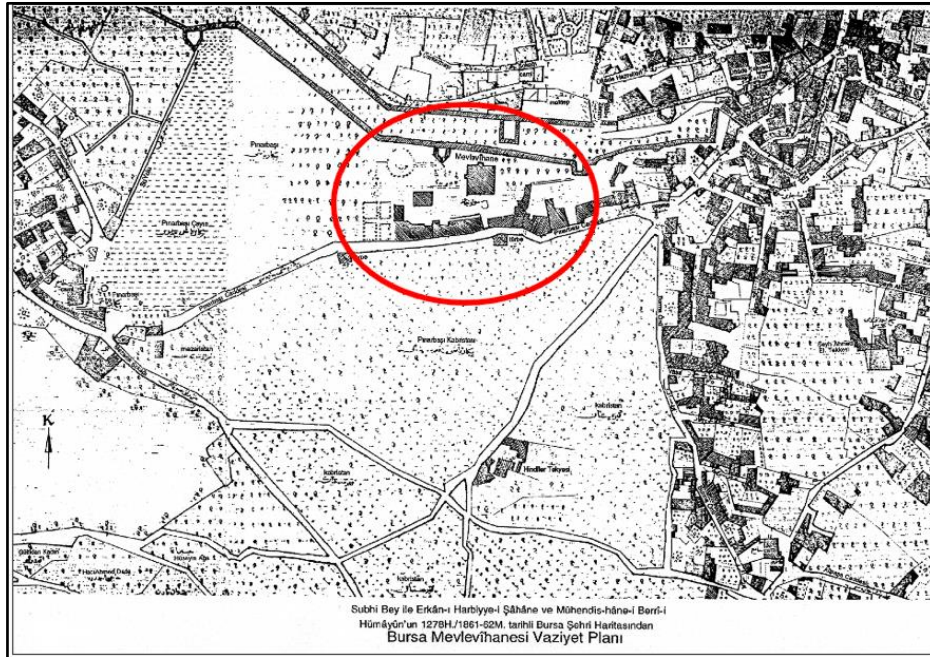


Figure 1. In 1861-1862 the Bursa Mevlevihâne Asitâne Site Plan (Suphi Bey ve Erkân-ı Harbiyye-i Şâhâne, Mühendishâne-i Berrî-i Hümâyûn, 1278)

3. The Historical Introduction (Widening, Rebuilding, Restorations) of The Bursa Mevlevihâne Asitâne Until 1925

The changes that the Mevlevihâne complex went through until its last period of activity in 1925 when the lodges and zawiya were closed, can be accessed from archival information and other sources. From these it can be seen that many repairs and additions were made to the Mevlevihane complex. In the 18th century Shaykh Ataullah Dede, who was the head of the lodge, applied to the Grand Vizier Derviş Mehmet Pasha in 1190/1776 and had the complex undergo a major repair (Ulusoy, 2020, 469, Kepecioğlu, 2009, 143).

The Mevlevihâne also underwent major repairs during the time of Shaykh Salih Dede (d.1246/1830). Even the semahâne took its final shape during these repairs (Öcalan, 2023, 39). In 1260/1844, when Ahçıbaşı Dede was the shaykh of the lodge, the Mevlevihâne was repaired and redecorated with some additions on the occasion of the arrival of Sultan Abdülmecid in Bursa (Ulusoy, 2020, 474).

In 1274/1857, during the reign of Shaykh Nizamettin Efendi, with the efforts of the Bursa Governor, Süleyman Refet Pasha, the kitchen of the lodge, some of its rooms and the türbe-i şerif (tomb section) underwent a major repairs (Ulusoy, 2020, 478) (Figure 2) (Figure 3).

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Figure 2. In 1862 the Bursa Mevlevîhâne Asitâne Site Plan (Suphi Bey ve Erkân-ı Harbiyye-i Şâhâne, Mühendishâne-i Berrî-i Hümâyûn, 1278)



Figure 3. Bursa Mevlevîhâne Asitâne in the 1879 Hisar Map (Elbas & Alkan, 2023, 13)

During the period when Mehmed Şemseddin Dede was the last shaykh, the Mevlevîhâne was extensively repaired on the request of Bursa's governor Mahmud Celaledin Pasha, and there exist detailed site plans and archival documents related to these repairs dated 1311/1895².

There were two site plans attached to the documents. The first of these is the site plan drawing of the then ("present") state of the dervish lodge in 1311/1895. The second repair site plan especially contained the plan of the buildings to be newly constructed or relocated. According to the first site plan³, on the east side of the mevlevihane's main entrance, there was the türbe-i şerif (tomb section), the mescid-i serif, then a gap that is thought to be a porch next to the

² Başbakanlık Osmanlı Arşivi (BOA), *Bâb-ı Âli Evrak Odası*. No:794, Gömlek no:59521, Belge:5/2, 1895.

³ BOA, *BEO*. No:794, Gömlek no:59521, Belge:5.



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dedes cells. To the east of these cells was the courtyard and exit ("küstahan door" through which unsuccessful dervishes were dismissed from the Mevlevîhâne) of the matbah-ı şerif to the Pınarbaşı road. The rooms of the matbah-ı şerif section were located to the north of these. There were toilets to the north of the matbah-ı şerif section, followed by the "gasilhâne" (funeral washing room) and the unconnected "stables-carriage area" to the northeast. On the west side of the main entrance, were the cells of the dedes, the *selamlık* male dervish quarters and the harem quarters, respectively. To the north of these buildings a detached "ruined matbah" was to be found. In the middle, in the north of the main courtyard of the Mevlevihane complex, there was a "semahâne". An "ablution fountain" was located between the semahâne and the tomb area, and there were also several "decorative pools" in various parts of the courtyard (Figure 4).



Figure 4. The first 1311/1895 Bursa Mevlevîhâne Asitâne Site Plan in the Ottoman Archives (BOA, Başbakanlık Osmanlı Arşivi, 1895)

In the second repair site plan⁴, on the east side of the Mevlevihane's main entrance from the Pınarbaşı Cemetery side of the mevlevîhâne, there was the türbe-i şerif and mescid-i şerif then the space thought to be a porch and the cells of the dedes.

To the east of these cells was the exit from the courtyard of the mathah-ı şerif to the Pınarbaşı road. To the north of these were located the units of the mathah-ı şerif section. However, the toilets, gasilhâne and stables-carriage area have been removed from this site plan. On the west side of the main entrance were to be found the cells of the dedes, the selamlık male dervishes' quarters and harem quarters. To the north of these were to be found a main kitchen and toilets which have been changed in design and dimensions from those in the previous site plan.

However, the semahâne, ablution fountain and decorative pools in the middle of the main courtyard were located in the same places as seen in the first site plan. Noticeable in this site plan are drawings on the west, of the traditional, home-type harem quarters' plans that was to be demolished. (Figure 5).

⁴ BOA, *BEO*. No:794, Gömlek no:59521, Belge:6.

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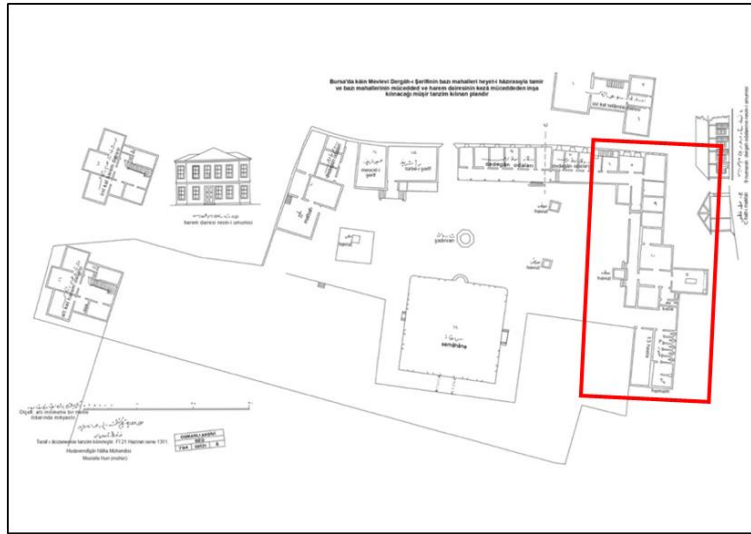


Figure 5. The second 1311/1895 Bursa Mevlevihâne Asitâne Site Plan in the Ottoman Archives (BOA, Başbakanlık Osmanlı Arşivi, 1895)

4. The History of The Bursa Mevlevihâne Asitâne After 1925, Until its Demolition in 1953

The Bursa Mevlevihâne Asitâne continued functioning until 1925, when all dervish lodges were legally closed (Figure 6). After 1925, the *selamlık* quarters of the Bursa Mevlevihâne were used as military barracks, and ownership of the *harem* quarters was left to the shaykh's family (Ulusoy, 2020, 480).

The semahâne was used as a masjid where the last shaykh, Mehmed Şemseddin Dede, who had been shaykh for 48 years, served as an imam and preacher. After the death of Mehmed Şemseddin Dede in 1931, the semahâne was at different periods of time used as a storehouse, a police station, hayloft and stable. Therefore, the Semahâne, from whose dome ney tunes had risen for almost three centuries, had become ruined due to neglect over time.

Except for the tomb section, the ongoing neglect of the various sections and their inappropriate functional use caused the building sections of the Bursa Mevlevihâne Asitâne complex to become deteriorated and unusable over time (Öcalan, 2023, 49-51) (Figure 7a.-7b.-7c.).





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Figure 6. Bursa Mevlevîhâne Asitâne in 192? Aerial photograph (Google Maps, 2023)



Figure 7a. The Semâhane section of Bursa Mevlevihane before 1953 in the Bursa General Directorate of Foundations Archives (Tanrıkorur, 2000, 180)



Figure 7b. The Matbah-ı şerif section, the Meydanı- şerif and the Türbe-i şerif of the Bursa Mevlevîhâne before 1953 (Tanrıkorur, 2000, 178)



Figure 7c. View of the main coutyard, the Türbe-i Şerif, the Dedes' Cells, the Selâmlık Quarters and the ablution fountain of Bursa Mevlevihane before 1953 (Tanrıkorur, 2000, 179)



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In the cadastral 1934 site plan of the Bursa Mevlevîhâne (Elbas & Alkan, 2023, 14), the borders of the türbe-i şerif and the mescid-i şerif located on the east side of the main entrance can be seen. However, here the cells of the dedes and the area thought to be a porch in the Ottoman archival 1311/1895 site plan, have been combined together and added to the matbah-1 şerif section. Although the borders of the toilets to the north of the matbah-1 şerif section can still be seen in this site plan, the *gasilhane* and stables-carriage units found in the Ottoman archival 1311/1895 site plan have disappeared as a result of the change in the boundaries of the north-eastern parcel (the sales, ownership change). The semahâne, the ablution fountain and decorative pools in the main courtyard can still be seen in this site plan. While the borders of the dedes' cells and the initial spaces of the selamlık quarters are visible on the west side of the main entrance, the harem quarters, main kitchen and toilet sections are not visible in this site plan due to the later changes which had been made to the parcel boundaries (Figure 8).

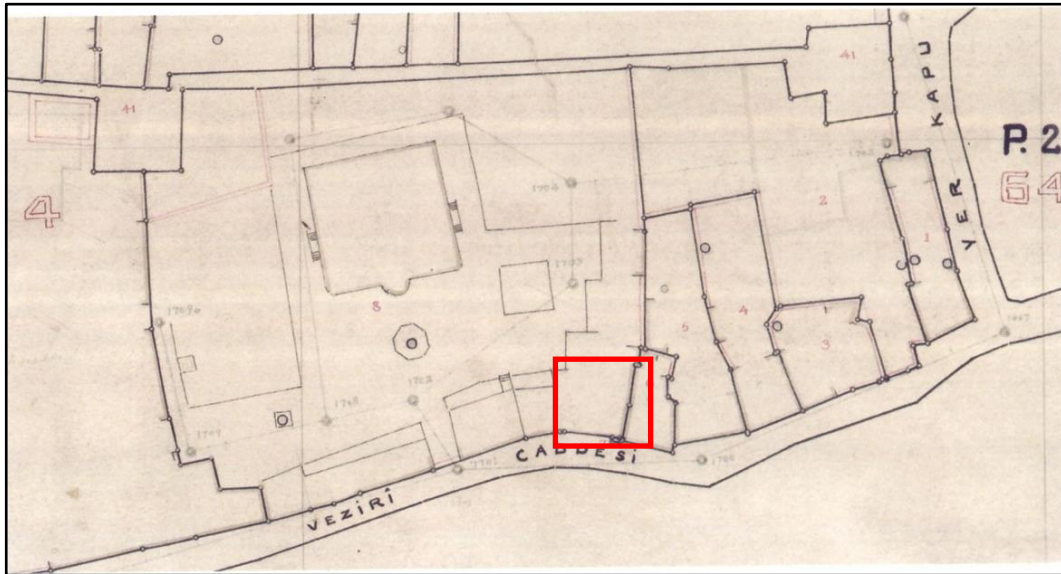


Figure 8. The 1934 Bursa Mevlevihane Cadastral Site Plan in the Bursa General Directorate of Foundations Archives (Elbas & Alkan, 2023, 14)

Although the Mevlevîhâne was in a ruined state, it had been able to survive until 1953 with the above-mentioned building units intact. However, upon the report prepared by Architect Ali Saim Ülgen on behalf of the General Directorate of Foundations in 1953, stating that the Mevlevîhâne was at risk of being ruined and that there was no budget for its restoration (Elbas & Alkan, 2023, 34), the Bursa Municipality informed the High Council of Historical Real Estate and Monuments that it wanted to build a water reservoir on the Mevlevîhâne plot of land. Although the legal process was still ongoing and the demolition decision had not been legally made, the Municipality started demolition works and constructed a water tank on the Mevlevîhâne plot of land (Öcalan, 2023, 51) (Figure 9).

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Figure 9. The water tank construction works in the Bursa Mevlevîhâne garden, 1953 (Elbas & Alkan, 2023, 37)

When the site plans of the Mevlevîhâne before and after 1953, found in in the archives of the General Directorate of Foundations (Elbas & Alkan, 2023, 18-19), are compared and evaluated, it can be seen that before 1953 (1) the semâhâne, ablution fountain (2) türbe-i şerif, (3) dedes' cells, (4) meydan-ı şerif, and (5) matbah-ı şerif sections were still present in the complex, while in the site plan after 1953 the (1) semâhâne and ablution fountain have completely disappeared due to the construction of a water reservoir. Except for (2) the tomb unit and (3) ruined dervish cells all the other units have been demolished (Figure 10).

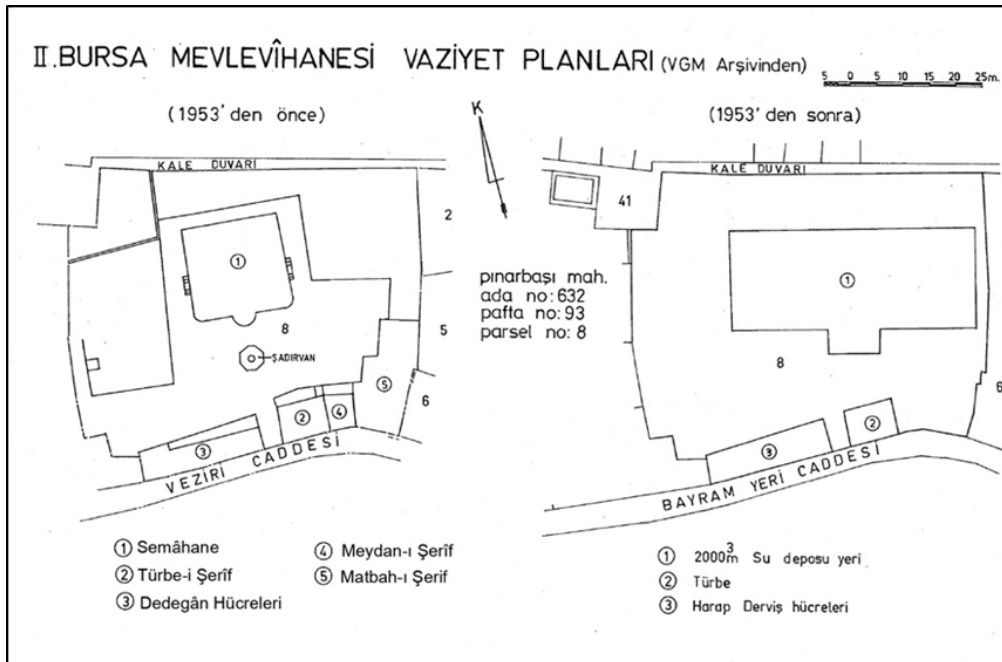


Figure 10. The Bursa Mevlevihane Site Plans before and after 1953 in the Bursa General Directorate of Foundations Archives (Elbas & Alkan, 2023, 18-19).

5. The Proposed Site Plan of the Bursa Mevlevîhâne Asitâne Around 1925

In the preparation of the site plan of the last functioning Bursa Mevlevîhâne Asitâne of around 1925, a meticulous study was made of all the archival records' information of the Mevlevîhâne, the site plans, maps, drawings and photographs which were evaluated historically.



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In the interpretation of the site plan of the Bursa Mevlevîhâne Asitâne around 1925, it can be seen that the connection of the Mevlevîhâne with Pınarbaşı Road is provided through 3 connections.

These are respectively (1) the main entrance of the Mevlevîhâne, (2) the matbah-1 şerif road exit (the küstahan door), and (3) the entrance to the harem quarters. After entering through the main entrance of the Mevlevîhâne, there is (4) the türbe-i şerif (tomb section) on the east side. Access to this building is from the porch, which is accessed from the main courtyard by three steps. There is also a small grave area called “*hamusan*”, in front of the tomb section facing the main courtyard. Next to the tomb section, there is (5) the rectangular planned meydan-1 şerif (labeled *mescid-i şerif* in the Ottoman archival plans) extending perpendicular to the courtyard. Then according to the information in the 1934 Cadastral site plan and 1953 photographs (6) the matbah-1 şerif section was drawn so that the dede cells and area thought to be a porch in the 1311/1895 site plan of Ottoman archival were combined and added to the matbah-1 şerif section. As seen in the 1311/1895 site plan of the Ottoman archives, (7) the toilets were drawn located to the north of the matbah-1 şerif section, followed by (8) the gasilhane while (9) the stables-carriages area were located independently from these units. (10) The arbor with a pool in the courtyard of the matbah-1 şerif section, (12) the semahâne and (13) the ablution fountain in (11) the main courtyard were drawn by evaluating all the archival site plans. On the west side of the main entrance, (14) 3 cells in a row with a front porch for the dedes, accessible from the courtyard were drawn with the help of old photographs (Photo 7c). At the end of these cells were located (15) the coffee preparation room and then (16) the *selamlık* male dervishes' quarters which was accessed by stairs from the porch. To the west of the *selamlık* quarters, (17) “the harem living quarters” for the shaykh's family and female dervishes was drawn according to the VGMA building survey plan drawings dated 1953, by R. Bediz and T. Kölük⁵.

In accordance to the data in the 1862 site plan map of Suphi Bey (Photo 2), the open area to the west of the harem quarters was drawn, with (18) the laundry-drying garden, the garden behind the harem with (19) its arbor and decorative pool and (20) rose gardens. To the northeast of the harem quarters, (21) the main kitchen, bakery-dining rooms for daily meals, (as seen located in the ruins, in the 1311/1895 site plan) and the outside (7) toilets were drawn.

The open area north of the *selamlık* male dervish quarters was drawn (22) as a courtyard with its three (23) decorative pools. The open area located on the embankment to the north of this courtyard was determined as (24) the vegetable and fruit gardens of the Mevlevîhâne in accordance with the data in the 1862 site plan map of Suphi Bey.

Finally, (25) the Bursa City fortress wall found in all the archival site plans was drawn in its location as the northern boundary of the Mevlevîhâne plot of land (Figure 11).

⁵ Refer to: Elbas, A., & Alkan F. (2023). *Bursa Mevlevîhânesi'nin Yeniden Ayağa Kaldırılması*, Bursa Büyükşehir Belediyesi, Bursa Müze Akademi Basım, Bursa, p. 21.

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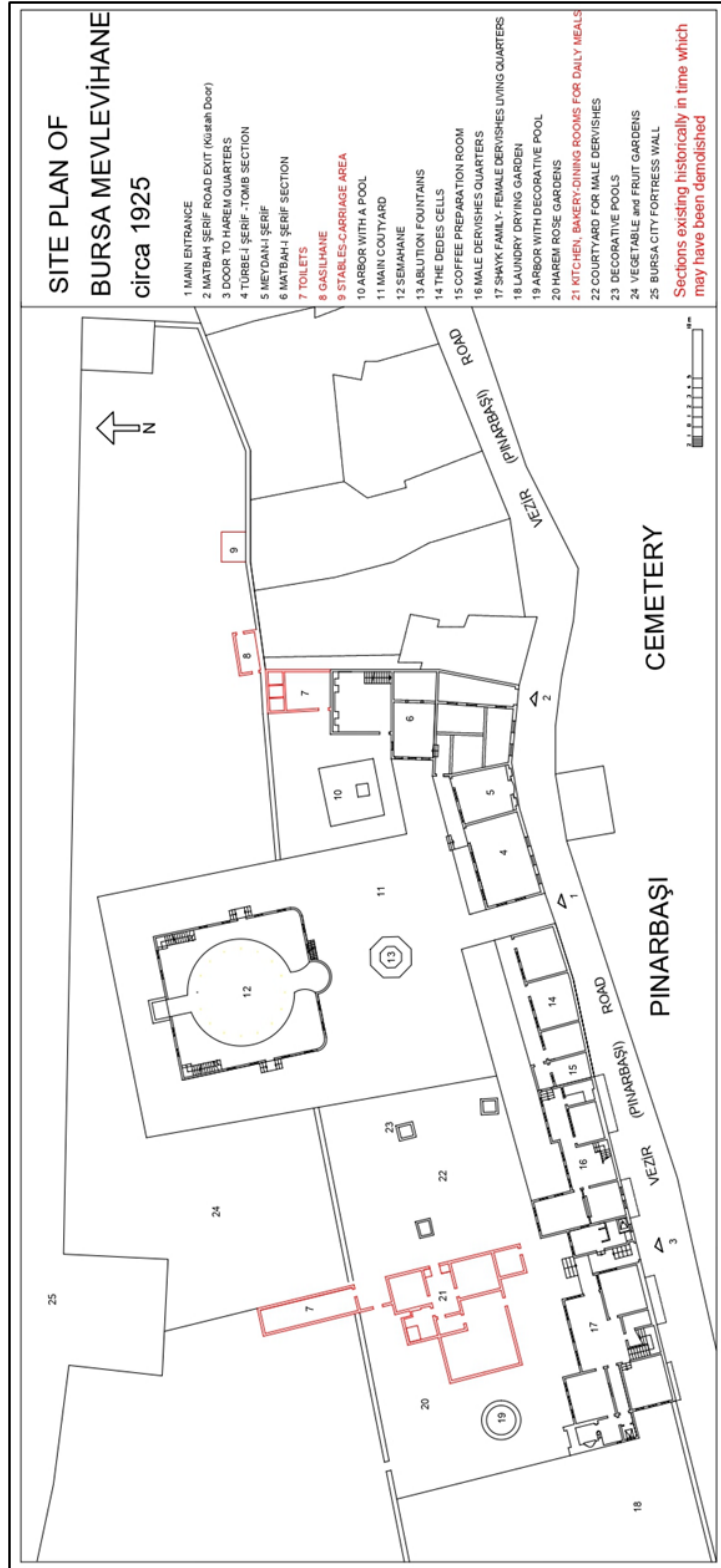


Figure 11. The proposed site plan of the Bursa Mevlevihane Asitâne around 1925



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6. CONCLUSION

The Bursa Mevlevîhâne Asitâne, which had been a major part of the spiritual and artistic life of the Mevlevî sufi order in Bursa for almost three centuries, was an important asitâne building complex in Anatolia, whose sections fulfilled the functions of worship, education, visit, shelter, eating-drinking and cleaning. The Mevlevîhâne, which had functioned from the date of its first building in the 17th century to 1925 had undergone many changes of expansion, repair and restoration. After 1925, while some of the construction units continued to function, some of them were used for other different functions. However, over time, they too became ruined due to neglect and abandonment. In 1953, it was claimed that the Mevlevîhâne was in ruins and that it was a risk and that there was no budget for its restoration. Therefore the demolition of the Mevlevîhâne began with the decision to build a water tank in its site area.

This study, aimed to create original data about the structures and site plan of Bursa's last Mevlevî Lodge, while it was still functionally active around 1925. To this end, the architectural site plan changes in the Bursa Mevlevîhâne Asitâne complex were evaluated by examining the rich supply of historical site plans, maps, drawings, and photographs available in the archives. Then all the site plans were brought to the same scale and superimposed one over each other, from which our proposed original site plan of the functioning Bursa Mevlevîhâne complex around 1925 was drawn. In the drawing, were placed the stable-carriage area, the *gasilhâne*, the main kitchen, the toilets, the laundry-drying garden, the rose, fruit and vegetable gardens, which were all in use at that time. It is hoped that this study will act as a guide to the correct restitution and reconstruction process of the complex; as well as revealing original data about the structures and site plan of Bursa's last actively functioning Mevlevîhâne around 1925.

Thanks and Information Note:

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**RESTORATION PROPOSAL FOR THE WOODEN DOOR WINGS OF
DIYARBAKIR BEHRAM PASHA MOSQUE**

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ABSTRACT

Woodwork, which came to the fore in the Turkish-Islamic architecture of the Seljuk and Principalities periods, also manifested itself in the Ottoman period. In these periods, advanced examples of woodwork are encountered both in terms of construction technique and ornamentation. Kundekari has an important place in traditional woodwork. There are types such as real künde-kari and imitation künde-kari in the art of künde-kari, in which a geometric composition is created by interlocking small geometric pieces. Real künde-kari examples, in which wooden pieces are interlocked without the use of nails or glue, are found in different parts of many historical buildings. Historical mosques are among the most important buildings where künde-kari examples are seen. Kundekari art is frequently encountered in the doors, pulpit and window shutters of historical mosques. The aim of this study is to provide restoration suggestions for the preservation of the door of the Behram Pasha Mosque in Diyarbakır and to transfer it to the future. The scope of the study consists of the wooden door wings of the Behram Pasha Mosque made with kundekari technique. In the study, the wooden door wings were examined on site. During the examination, photographs of the door wings were taken and measurements were taken. Using the measurements and photographs, a drawing of the door was made in computer environment. As a result, the missing geometric parts required for the integration of the wooden door wings of Behram Pasha Mosque were identified and a restoration proposal was developed for the door wings.

Keywords: Behram Pasha Mosque, Woodwork, Wooden Door Wings, Kundekari, Restoration.

1. INTRODUCTION

In the early periods when wood was used as an ornamental element in buildings, geometric patterns were drawn on one-piece wooden panels, and depth was given to the drawings. These panels were brought together on the surface where the wood would be used, and the surface was covered. The wooden panel, which was a single piece, was cracked into pieces in the historical process, and the integrity of the panels was disrupted by moving away from each other. This problem was solved by the künde-kari technique, in which large surfaces are formed by bringing small pieces of wood together using a channel system without any binder (Eyigün and Metin, 2007).

Defined as ornamentation consisting of small interlocking timbers, künde-kari is a production technique used in Seljuk and Ottoman period woodwork (Söğütü, 2004; Sözen and Tanyeli, 1986; Ödekan, 1997; Tufani, 1980).

The main purpose of using the künde-kari technique is to prevent problems arising from the expansion and narrowing of wood, which is an organic material, by being exposed to external influences (Soysal, 2007; Büyükçanga, 2000).



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Söğütlü (2004) defined künde-kari as *"the construction technique applied in the interlocking joining of geometrically shaped, small-sized parts such as triangles, squares, stars, and pentagons in order to obtain large and decorative surfaces with reduced internal stresses in order to enable the work that can be carried out with the effect of the relative humidity and temperature change of the environment in which it is used"*. According to the production method, künde-kari is divided into two categories: real and imitation.

In the real künde-kari technique, the pieces are joined by means of grooves without using fixatives such as nails (Kürklü, 2011; Yüksel et al., 2016). In imitation künde-kari, where the construction method in real künde-kari is ignored and visual success is imitated to obtain a künde-kari appearance, the parts are connected to each other with fasteners, requiring less mastery (Özdemir, 1999; Söğütlü, 2004; Soysal 2007).

The künde-kari examples that have survived from the old periods to the present day reveal the durability of the products made with this technique. These artefacts reflect the transition from eastern culture to western culture as well as the aesthetic characteristics of their periods.

The use of the technique, which was extensively used in Seljuk and Ottoman mosque doors, minbars, and shutters, has decreased in recent years. In addition to the benefits it provides in construction, the fact that few works produced with the künde-kari technique have survived to the present day makes the künde-kari technique valuable (Yüksel et al., 2016; Sönmez, 2001).

The entrance door of Behram Pasha Mosque, which is an Ottoman period building, is a work made with the künde-kari technique. The door, which has survived from the period when it was built to the present day and continues its existence in its original place, is important in terms of reflecting the style of the period and being an example where the künde-kari technique is applied. When the studies in the literature were examined, no study on the documentation and restoration of the door of Behram Pasha Mosque was encountered.

Documenting the door and transferring it to the future is important for the sustainability of our cultural heritage. For this reason, the study aims to document the wooden door of Behram Pasha Mosque and develop a restoration proposal for the door to be transferred to the future.

2. MATERIALS and METHODS

Behram Pasha Mosque, located close to the Mardin Gate within the Diyarbakır Walls, is located on Bayrampaşa Street in the Abdaldede neighborhood (Figure 1).



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Figure 1. Behram Pasha Mosque location (Google Earth)

It is known that the building was built between 1564 and 1572 by Behram Pasha, the 13th Ottoman governor of Diyarbakır. According to *Tuhfetü-l Mimarın*, the building is known to be a work of Mimar Sinan (Sözen, 1971).

The garden of the mosque is entered through the gates in the north, east, and west directions. In the center of the garden is an octagonal fountain sitting on eight columns. To the south of the fountain is the main structure of the mosque. The building has a square plan and is covered with a single dome sitting on an octagonal pulley. To the north of the harim is the last congregational place. This area has a double portico. This feature distinguishes the building from other Diyarbakır mosques (Karaca, 2017). While the inner portico consists of five domes, the outer portico was built in a flat shape (Figure 2).

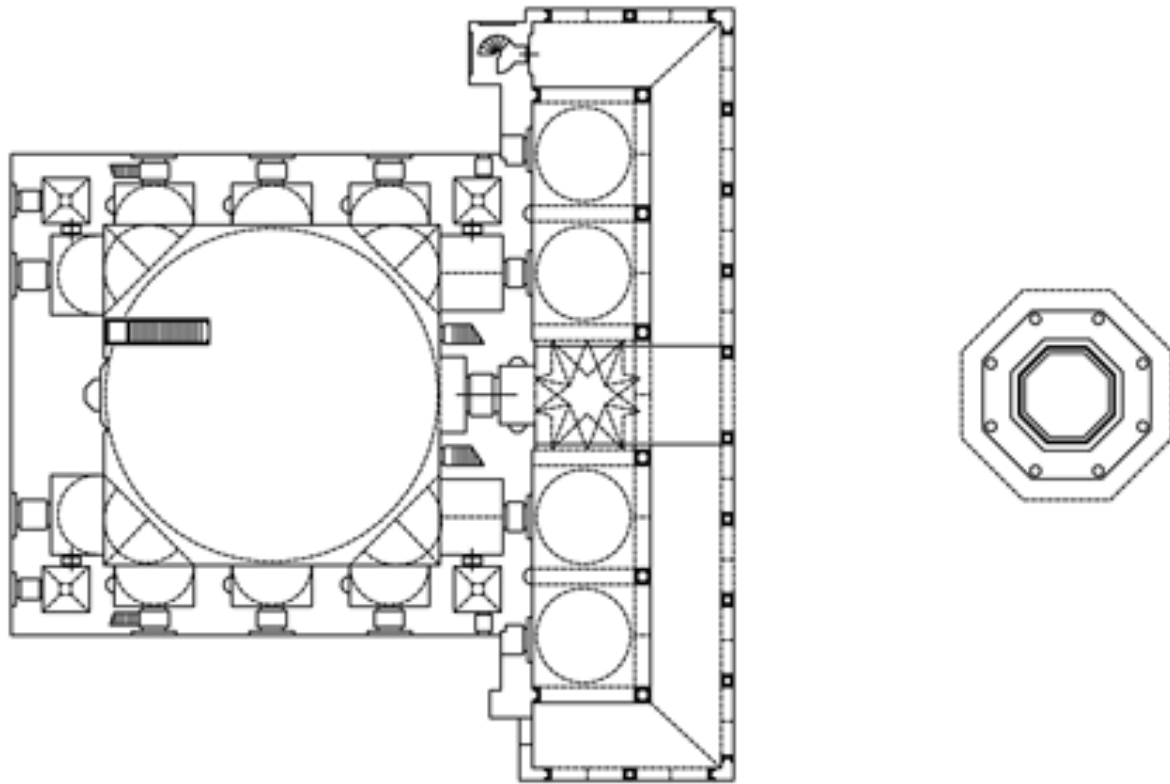


Figure 2. Behram Pasha Mosque plan (www.archnet.org)

There is a symmetrical order on the north wall of the harim, opening to the porticoes. This symmetrical order is according to the crown door in the center of the wall. The door protrudes from the facade. The inner surfaces of the door niche were built with black and white stones in alternating patterns. A flattened arch is formed in this system. There is a niche with muqarnas on the molding. This niche is covered with a five-slice arch. On the outer corners of the niche, under the arch, there are recessed columns. The bodies of the columns are plain, and their capitals are muqarnas. After the arches, there is a border surrounding the door. Above this is a pointed arch.

The scope of the study consists of the wooden door wings made with the künde-kari technique of the Behram Pasha Mosque belonging to the Ottoman period located within the historical city walls of Diyarbakır. Since the door wings of Behram Pasha Mosque are made with the künde-kari technique and the door is in danger of disintegration due to the missing geometric parts on the door wings, it is necessary to present a restoration proposal for the door wings.

In the study, wooden door wings were examined on site. During the examination, photographs of the door wings were taken, and measurements were taken. Using the measurements and photographs, a drawing of the door was made on the computer. Then, the missing geometric parts required for the integration of the wooden door wings of Behram Pasha Mosque were identified, and a restoration proposal was developed for the door wings.

3. FINDINGS and DISCUSSION

When the door wings of Diyarbakır Behram Pasha Mosque are analyzed, it is understood that the door is made of wooden material. It is evident that the real künde-kari technique was applied



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in the construction of the door. It is seen that the door wings are basically composed of inner filling pieces and spine slats derived from three ten-pointed stars in the vertical direction. In addition to the ten-pointed star, the inner filling pieces consist of five-pointed stars, hexagons, deltoids, and new pieces formed by cutting these pieces as a result of coming to the edges (Figure 3).

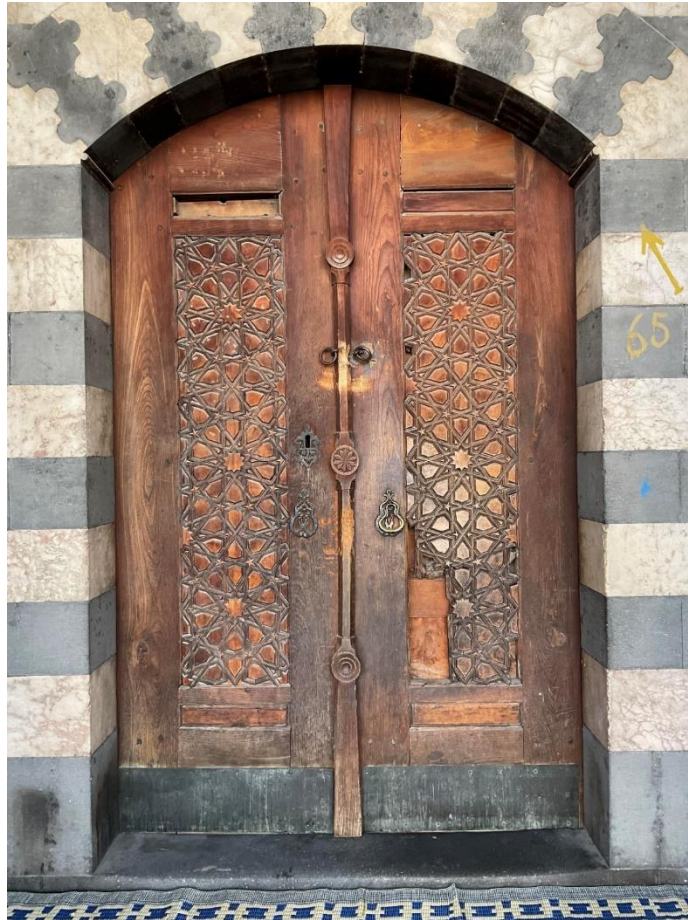


Figure 3. Behram Pasha Mosque entrance gate

In the study, measurements of the door were taken and drawings were made. By comparing these drawings with the door, missing parts on the door wings were identified (Figure 4). The production of these parts and their placement on the door wings will contribute to the integration of the door.

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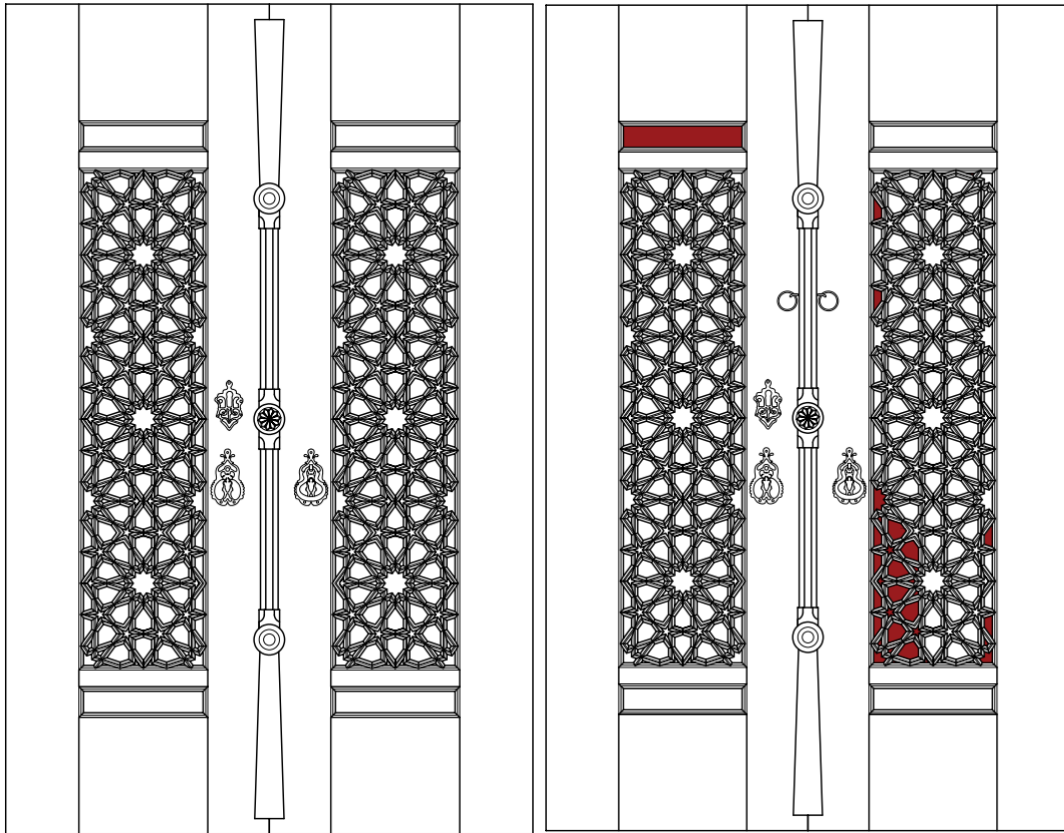


Figure 4. Drawings of the door wings of Behram Pasha Mosque

The door wings, which are formed by taking the ten-pointed star as the centre, have inner filling pieces and spine laths in different geometric forms (Figure 5).

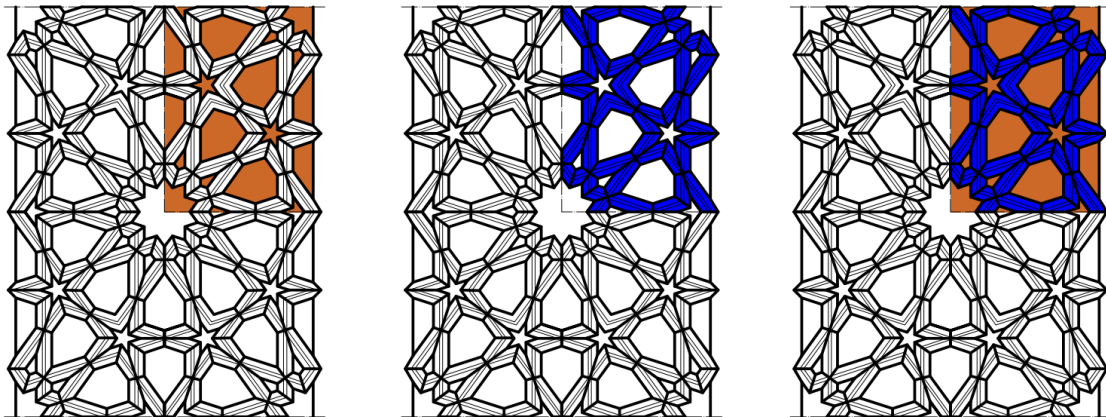


Figure 5. Drawings of the inner filling parts and spine laths of the door wings of Behram Pasha Mosque

On the wooden door wings of the Diyarbakır Behram Pasha Mosque, it is seen that pattern differences are formed as a result of the opening of the ten-pointed star in the center and its intersection with the parts derived from other ten-pointed stars (Figure 6).

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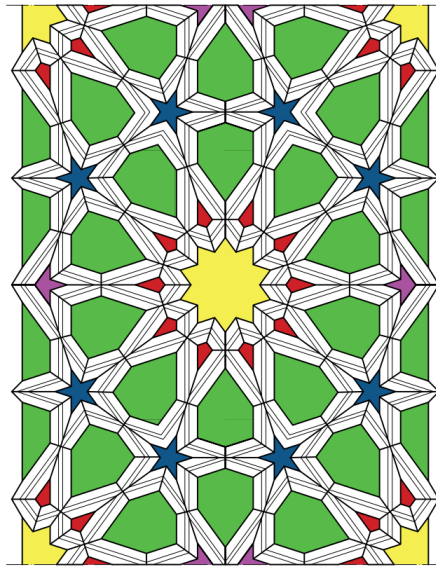


Figure 6. Pattern differences of the door wings of Behram Pasha Mosque

On the wooden door wings of Diyarbakır Behram Pasha Mosque, there are different metal accessories that function as locks and knockers. Although deterioration is also observed on these metal accessories, the presence of missing parts draws attention (Figure 7).

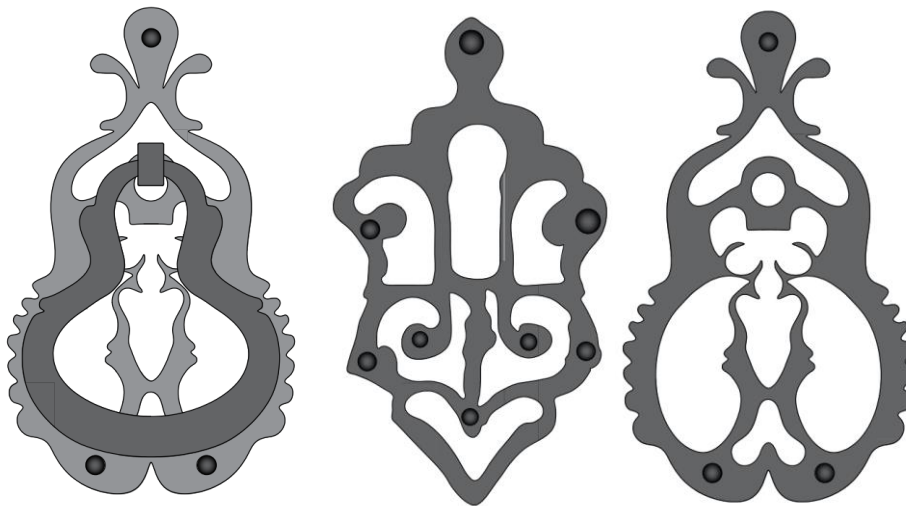


Figure 7. Metal accessories on the door wings of Behram Pasha Mosque

4. CONCLUSION and RECOMMENDATIONS

Diyarbakır Behrampaşa Mosque is important both for its historical value and for being a work of Mimar Sinan. Due to the fact that the mosque has a double portico, the structure stands out among Diyarbakır mosques. In the historical process, deterioration has occurred in the structure. One of these deteriorations is the entrance door, which is important in terms of construction technique. The door is made of wooden material, and the künde-kari technique was used in its construction. On the door wings, there are three ten-pointed stars in the vertical direction and internal filling pieces and spine laths derived from these ten-pointed stars. Although the spine



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laths on the door wings show very different dimensions, the filling pieces consist of deltoids, five-pointed stars, hexagons, and new forms formed by the cuts on the edges of these pieces. There are also metal accessories on the door wings. These metal accessories are used as locks and knockers.

The kundekari door of the Diyarbakır Behram Pasha Mosque has missing pieces due to fragmentation. Since the door was made with the Kundekari construction technique, the missing pieces reveal the possibility of the door falling apart. The door wings are missing, both in the filling pieces and the spine laths. The missing parts on the door are not limited to wooden parts. There are also deficiencies in the metal accessories on the door. In this context, a proposal to integrate the door was developed in the study. In the study, a drawing of the door was made by taking the measurements of the door and photographing it. Depending on these drawings, missing parts in both wooden sections and metal accessory sections were identified and drawn. In this context, it is important to complete the door in line with the drawings made in the study in order to protect and transfer the wooden entrance door of Diyarbakır Behram Pasha Mosque, a work of Mimar Sinan, built with the kündekari construction technique, to the future. Since the door wings were constructed with the real kündekari technique, nails, etc. were not used in the joining of the parts, but it is seen that nails were added later to prevent disintegration from the parts with missing parts. These nails need to be removed during the integration. In addition to the integration of the missing parts in the wood on the door wings, other deterioration in the wood should be detected and removed; harmful insects in the wood should be removed. At the same time, the removal of rust on metal accessories is also important for the protection of the door.

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**DESIGN AND PLANNING SUGGESTIONS TO IMPROVE THERMAL COMFORT
SUITABLE FOR CLIMATE TYPES IN ANATOLIA**

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ABSTRACT

With the increase in population in cities, there is a need for new residential areas in urban areas, and in order to meet this need, the use of open-green areas in cities is one of the biggest reasons for micro-scale climate change in cities. Increasing building density creates a heat island in cities and has negative effects on the urban thermal environment. Changes in urban microclimatic conditions have negative effects on the health of urban residents. Increasing health problems lead people to take into consideration factors such as ecological balance, urban comfort, proximity to nature and clean environment, which were not considered important in the past, when determining their living places. Another factor that has gained importance recently is "Thermal comfort". Thermal comfort; These are urban climate conditions where people feel healthier, happier and more dynamic. When the thermal comfort value is within appropriate ranges, people feel healthier, happier and more peaceful. In this context, when creating new living spaces for people, it is necessary to design and plan by taking into account the comfort values of the place. Therefore, in recent years, thermal comfort has become one of the issues that need to be taken into consideration in urban landscape planning studies. In this context, suggestions are made in the study about the importance of thermal comfort, environmental factors affecting thermal comfort in cities, points to be considered in thermal comfort-oriented urban design and planning with different climate types. These suggestions can make a significant contribution to the creation of sustainable cities.

Keywords: Urban Heat Island, Urban Climate, Thermal Comfort, Urban Planning, Urban Design.

1. INTRODUCTION

The factors affecting the establishment of the first permanent settlements of humankind in the world have been subject to many changes until today. It is known that in the early days, the feeling of solidarity was effective in resisting external attacks and fighting against nature. Thus, settlement models have emerged where people live together more in order to resist dangers. agriculture and later the industrial revolution, which greatly influenced human history, played a major role in the establishment of cities. After the agricultural revolution, when cities were established, geographies with a more suitable climate for agriculture and with sufficient rainfall were preferred. The first settlements established in these geographies were in the form of models called simpler village settlements. With the Industrial Revolution, cities developed



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rapidly and gained a new form, and the population in these places increased more than ever before and continues to increase today. With the increasing need for housing with the industrial revolution, urban areas began to be needed for different uses. To meet these needs as soon as possible, an unplanned, un-programmed, and rapid urbanization process has begun. Due to this unplanned and un-programmed urbanization, natural green areas have been destroyed and the density of dysfunctional buildings in these areas has increased, ignoring the benefits they provide to the world and people. In addition, the change in the morphological structure of the urban fabric the decrease in vegetative surfaces, and the increase in hard surfaces pave the way for the formation of negative microclimatic conditions, causing significant environmental problems in cities. As a result, people living in cities that grow uncontrollably are faced with cities whose functions decrease and pose problems for human health. To reduce the problems caused by unplanned urbanization; Some terms such as ecological balance, clean environment, and comfort conditions are taken into consideration by planning experts. With the increasing income level, these factors come to the fore and are seen as the most important factors in planning the cities where people will live. Based on this, we will focus on the thermal comfort factor, which is effective in carrying out recreational activities in Anatolian cities, and the issues that need to be taken into consideration in urban planning and design.

a. The Importance of Thermal Comfort in Urban Planning and Design

In many developed and developing countries, rapid urbanization and cities that are far from ecological concerns and shaped without any planning have caused individuals to be faced with cities that are far from comfortable and useless. Recently, the number of people living per unit area in cities has increased. As a result, cities became crowded and gloomy structures formed in the focal points of the cities. In these areas, there are many thermal stress factors such as air temperature, humidity and wind currents resulting from excessive construction, which affect human productivity and human health and are environmental problems (Sevik and Belkayali, 2012; Topay and Parladir, 2015).

People living in urban areas where these thermal stress factors are highly exposed feel uneasy and move away from these areas or create their own solutions to live more comfortably there. However, the solutions people produce often harm the environment. For example, the energy used inside buildings for heating or cooling is one of the most important causes of environmental pollution. However, in recent studies on this subject, it has been determined that open spaces have a positive effect on the city's microclimatic conditions, that is, thermal comfort levels (Nikolopoulou et al. 2001). In order to prevent people from finding solutions on their own, thermal comfort-sensitive planning should be made in order to increase the thermal comfort level and prevent environmental problems. Landscape Architects have a great responsibility in thermal comfort-sensitive planning.

b. Thermal Comfort Focused Urban Design in Cities and Aspects to Consider in Urban Planning

One of the most important points to consider in thermal comfort-sensitive planning in cities is the urban climate. When the relationship between climate and planning is mentioned, the situation that comes to mind should be improving the quality of life in outdoor spaces. Some recent studies reveal that thermal environmental factors such as outdoor air temperature, wind speed, relative humidity and solar radiation affect the thermal comfort, perception and therefore satisfaction levels of individuals living in these areas (Alpay et al., 2013). Most people feel



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comfortable in the temperature range of 20-25.5 °C and 30-60% relative humidity (İlten et al., 2017). Therefore, in order for people to be comfortable in their environment, they must be within a certain temperature, wind and humidity range. This range is called the comfort zone (Boz, 2017). Although there are different climate types exhibited in the world, the comfort range is always the same. In order to achieve this comfort range, plans and designs are made according to each region and each climate type. According to the monthly and annual temperatures and amount of precipitation, the distribution of precipitation throughout the year, and the relationship between precipitation and temperature and natural vegetation, the letter system was used to determine Köppen-Geiger climate types and the climates were grouped into 5 main types (Erlat, 2014; Türkeş, 2010). (Figure 1.). According to the Köppen Climate Classification, B, C and D type climates are observed in Turkey (Peel et al., 2007). (B) type climate; It is seen in the inner parts of Turkey and a part of Southeastern Anatolia, and its most distinctive feature is that it is far from water sources such as seas and lakes and is dominated by dry hot summers and dry cold winters. (C) type climate; It covers the coastal areas and most of Southeastern Anatolia and exhibits a mid-latitude climate with mild humid winters.

In (D) type climate; It is the second climate type with the largest impact area in the world and has cold winters. It generally exhibits continental climate characteristics (Peel et al., 2007). In cities with different climate characteristics, it is necessary to determine local-specific design criteria in order to ensure thermal comfort. These criteria should be climate-sensitive, that is, they should be aimed at protecting urban residents from extremely hot or cold air and surface temperatures, humidity rates and wind currents that will negatively affect thermal comfort.

Tablo 1. Characteristics of basic climate types according to the Köppen-Geiger climate classification (Peel vd., 2007) Table Description: T: Annual Average Temperature, P: Total Annual Precipitation

Harf	Tanım	Temel özelliği
A	Nemli tropikal	Kış mevsiminin yok ve tüm ayların ortalama sıcaklığı 18°C'nin üstündedir. $T_{min} \geq +18^{\circ}\text{C}$
B	Kurak	Buharlaşma yağıştan fazladır ve sürekli su eksikliği vardır $P_{yillik} < 10 \times P_{eşik}$
C	Kışları ılıman nemli orta enlem	En soğuk ayın ortalama sıcaklığının 18°C'nin altında ve 0°C'nin üstünde, en sıcak ayın ortalama sıcaklığı 10°C'nin üstündedir $T_{maks} > 10^{\circ}\text{C}$ ve $0^{\circ}\text{C} < T_{min} < +18^{\circ}\text{C}$
D	Kışları soğuk nemli orta enlem (Karasal iklim)	En soğuk ayın ortalama sıcaklığı 0°C'ye eşit veya altındadır ve en sıcak ayın ortalama sıcaklığı 10°C'nin üstündedir $T_{maks} > 10^{\circ}\text{C}$ ve $T_{min} \leq 0^{\circ}\text{C}$
E	Polar	Yaz mevsimi yoktur ve en sıcak ayın ortalama sıcaklığı 10°C'nin altındadır. $T_{maks} < +10^{\circ}\text{C}$

In the study, suggestions were made on what to pay attention to in planning and design in order to improve thermal comfort in the climate types exhibited in Turkey, and suggested designs were developed by using the same space plane for these climate types. Climate types exhibited in Turkey;

(B) Arid climate zone: In this climate region, which is seen in the inner parts of Turkey and a part of the Southeastern Anatolia Region and where the continental climate prevails, it is similar to the desert climate due to the high temperature differences during the year and day. The



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summers are very hot and the winters are very cold. is mentioned (Dizdar, 2009). It should be known that, as in every climate zone, there are summer and winter months in these climate zones, and accordingly, planning and design should be made considering the 4 seasons.

- In this context, while making a design suitable for thermal comfort in the arid climate region;
- In cities with an arid climate, surface and air temperatures should be reduced during the summer months and the humidity rate should be increased by exposing urban residents to less solar radiation.
- In order to increase air circulation in these climatic regions, buildings should be designed in a separate order, with different heights and widths so that they do not block each other's wind flow (Chan et al., 2003).
- In order to be protected from the negative effects of the sun, care should be taken to ensure that the plantings in these places have shade and cooling properties. For this purpose, deciduous, densely leafed and large-diameter trees should be included in the summer months in order to both reflect some of the sunlight reaching the place and provide shading at street level and low parts of building facades (Gaitani et al., 2007; Lin, 2009).
- In order to prevent excessive heat increases that may occur indoors and outdoors during the summer months, the east, west and south facades of the buildings surrounding the space should be surrounded by broad-leaved trees and tall shrubs or materials with low heat storage capacity. In addition, building facades and floors should also be planted. For the winter months, the opposite should be done.
- To increase humidity values in these climate zones; It is necessary to plant plants that will increase the humidity level at street level, on building facades and roofs. In addition, water surfaces can be used in spaces to increase the humidity level.
- In order to maintain humidity values, the sky visibility of the space should be increased without ignoring sun exposure (Johansson and Emmanuel, 2006).
- Since they have a cooling effect on water surfaces and affect the humidity in the environment, their use should be increased in summer months and the use of these items should be avoided in winter months (Gaitani et al., 2007; Xu et al., 2010).
- These elements should be designed in the direction of the prevailing wind in order to benefit more from the cooling effect of water surfaces during the hot period. Establishing this relationship should be avoided for the cold period (Yu and Hien, 2006).
- If it is present in hot climate regions, flows coming from areas with water surfaces such as seas and lakes should be provided to reach the space (Johansson and Emmanuel, 2006).
- Urban canyons should be oriented on east-west or similar axes to benefit more from sunlight during the winter months. During the summer months, canyons extending on north-south and similar axes should be designed (Toudert and Mayer, 2004; Johansson and Emmanuel, 2006; Toudert and Mayer, 2007).



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- It is important to increase the surface and air temperatures of the place during the winter months and to ensure that urban residents have access to more sunlight. In addition, air flows that will cause discomfort by causing cooling both in the space and on the human body should be restricted. For this purpose, urban canyons should be oriented as parallel as possible to the dominant wind flow (Georgakis and Santamouris, 2006; Johansson and Emmanuel, 2006).
- The use of green surfaces and permeable surfaces that will absorb water at street level should be increased.
- Materials with high reflectance values should be preferred on building facades and floor coverings in order to prevent the storage of incoming sunlight in areas with arid climate characteristics. In the study, a design was developed for the summer months of arid climate regions in order to be a recommendation.

These climatic regions experience dry summer months, and people who spend time here feel uncomfortable due to conditions such as low humidity and excessive exposure to sunlight. In the draft developed to prevent these problems (Figure 2);

- Buildings were planned far from each other to avoid obstructing wind currents.
- It was used inside the space to benefit from the cooling properties of water surfaces. At the same time, the water surfaces were planned parallel to the prevailing wind direction to provide more cooling properties.
- In order to be protected from sunlight during the summer months, plants with broad leaves and high shading function were used in the space.
- Green surfaces that provide water absorption were used on the street surface.
- Roof gardens and water surfaces were used on building roofs to increase the humidity level.
- In order to increase the humidity value, species that increase the humidity value of the plant species used on the roofs and inside the space were used.
- Spaced broad-leaved trees and shrubs were used to ensure the distribution of wind movements within the space.
- In order to prevent sunlight from being stored in the area, materials with high reflectance values were used on building facades and floor coverings.
- In order to prevent overheating in both exterior and interior spaces during hot periods, it was planned to have broad leaves in front of the western and southern facades of the buildings surrounding the space.



Figure 2. A design example that increases the thermal comfort level for summer in type B climate zones

C- Temperate-humid climate zone: It is seen in the Black Sea and Marmara regions, where there are large water bodies such as seaside or lakes and rivers that increase the humidity in summer and winter. These are regions where temperature differences between day and night are small, summers are mild and winters are cool, and the amount of precipitation and humidity is high. In order to ensure the thermal comfort of people living in these regions, attention should be paid to reducing surface and air temperatures during the summer months and ensuring appropriate air circulation in the design of spaces. During the winter months, arrangements should be made to provide sunbathing opportunities and reduce wind current. Since the amount of humidity has a great impact on thermal comfort in this climate type, care should be taken to reduce humidity levels in every season.

In this context; while planning and designing in accordance with thermal comfort in the temperate-humid climate region;

- The height/width ratio of urban canyons should be designed at a rate (lower than two) that will not hinder the prevailing wind flow in order to keep the amount of humidity at comfortable levels in all seasons (Johansson and Emmanuel, 2006).
- In order to distribute the existing humidity in the air and prevent its excessive increase, the space should be oriented parallel to the prevailing wind in summer and winter months, and the use of plants that will increase evaporation in the space should be avoided (Johansson and Emmanuel, 2006).
- In order to reduce the amount of moisture, natural green surfaces or permeable surface coatings that will not hinder the absorption of water at street level should be used (Kottmeier et al., 2007).

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- In order to prevent users from feeling uncomfortable due to excessive humidity increase, the use of water surfaces in the space should be avoided at all times (Gober et al., 2010).
- Residences are positioned so as not to interfere with each other's sunlight, air movement and solar radiation.

The biggest problem of this climate zone is that the humidity is high and therefore people living here feel hotter than the current temperature. In this case, it causes the people living here to feel uncomfortable. In the draft developed to prevent these problems (Figure 3);

- The canyons within the venue are planned to be less than 2 meters high in order not to hinder wind movement.
- Since humidity is a big problem here, the place was planned parallel to the prevailing wind in order to disperse the existing humidity.
- Again, in order to reduce the humidity factor, the plant species used in the space should not increase evaporation and permeable materials were used with plant surfaces that allow the absorption of water at street level.
- In order to prevent increased humidity, water surfaces were not used in the space.
- Finally, it was designed to ensure that there is sufficient distance between the residences so that they do not block each other's wind and sunlight.

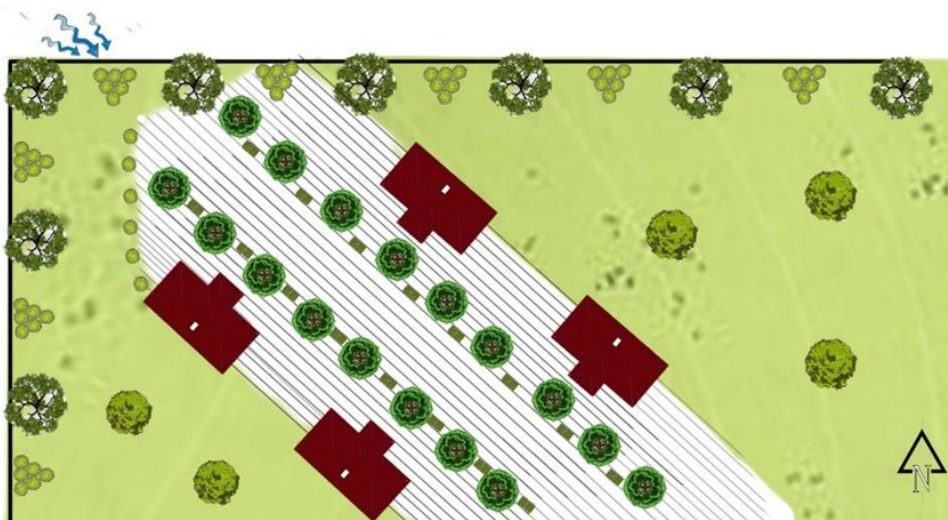


Figure 3. A design example that increases the thermal comfort level for the summer season in type C climate zones

D- Continental (Cold) Climate Zone: These are regions where the temperature difference between summer and winter and night and day is high, and precipitation generally occurs in spring and winter. In this climate type, the vegetation that usually blooms in spring dries out during the dry summer months and takes on a steppe appearance. The dominant season of these regions is winter because winter comes very early to these regions and the most precipitation is in the form of snow. In order to ensure the thermal comfort of urban residents in these regions, it is necessary to reduce surface and air temperatures in summer, reduce humidity and ensure proper air circulation within the space. During the winter months, the surface and air temperatures of the place should be increased, urban residents should be provided with more



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sunlight, and wind currents that may cause people to feel uncomfortable should be restricted and the humidity rate should be reduced. Although it is called a cold climate region, it should be taken into consideration that summer months are also experienced in these regions. In this regard, winter and summer months should be considered when making design decisions. Of course, since the winter months are longer, this should also be taken into consideration in decisions.

In this context, when designing for thermal comfort in the continental climate region;

- South should be preferred as the orientation direction.
- Water surfaces have a cooling effect in the place where they are used. Due to the harsh winter months, the use of water surfaces that will increase the cooling effect in outdoor areas should be avoided.
- The dominant wind direction should be determined and planting should be done to reduce the effect of the wind. High-tall coniferous trees should be planted in the first row, preferably by adopting the staggering method. In the planting works to be carried out in the north-west direction, coniferous vegetation should be used more intensively to block the wind, and the southern direction should be left open or deciduous plants should be used to ensure the passage of sunlight that will warm the region during the winter months.
- In order to restrict air circulation in cold climate regions, the surrounding buildings should be adjacent to each other and have close heights and floor areas (Chan et al., 2001; Chan et al., 2003).
- Urban canyons should be oriented as perpendicular as possible to the prevailing wind flow (Johansson and Emmanuel, 2006).
- Wind currents disturb people and reduce their comfort level. Especially in the winter months, this level of discomfort increases even more. In order to prevent this, the gaps where the prevailing wind comes should be identified and passages or plants and street furniture should be used to prevent this wind flow from affecting the users.
- In order to store the sun rays during the winter months and make the evenings warmer, care should be taken to choose dark colored floor coverings used outdoors to have more heat retention.
- In order for people living in these climate zones to increase their use of outdoor spaces during the summer months, solutions should be provided to increase the humidity level. For example, plantings that increase the humidity effect can be made at street level.
- Deciduous, densely leafed and large-diameter trees should be used in order to reflect some of the sunlight coming into the place during the summer months and to provide shading at the street level and in the low parts of the building facades. If artificial materials are to be used, care should be taken to ensure that these materials have low heat storage capacity and high reflectivity. The use of these materials should be avoided during winter months (Toudert and Mayer, 2004).
- If it is present in cold climate regions, the access of flows coming from areas with water surfaces such as seas and lakes into the space should be restricted. In the hot period, blocking the access of these flows should be avoided (Johansson and Emmanuel, 2006).

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The biggest problem of this climate region is the high temperature differences between day and night and the high number of cold days. For this reason, people living here feel uncomfortable with cold weather conditions and wind movements that cause cold weather conditions to be felt more. In the draft developed to prevent these problems (Figure 4);

- Wind movements were restricted by considering planting in the form of screening in the direction of the prevailing wind.
- It was thought that people could benefit from sunlight in winter by using deciduous plants in the east and west directions.
- By positioning the buildings vertically to block the prevailing wind, wind movements are prevented from reaching the interior areas.
- In addition, planting was done between the buildings to prevent wind movements that may come between the buildings.
- In order to absorb the sun's rays and make the nights warmer, dark colored coatings and floors that absorb the sun's rays were used on the building facades, roofs and floors.
- Since water surfaces have a cooling effect, they were not considered to be used in this design.



Figure 4. A design example that increases the thermal comfort level for the winter season of D type climate zones

Apart from these, the points to be taken into consideration when planning and designing in accordance with thermal comfort in urban spaces in all climatic regions are;

- Establishing new residential areas in comfortable areas in terms of thermal comfort will significantly save the energy that will be spent to transform uncomfortable areas into comfortable areas. For this reason, it is recommended to use comfortable areas to create comfort maps of the region before planning new residential areas (Alpay et al., 2013; Çalı, 2018).
- In order to prevent heat islands, which have a great impact on thermal discomfort, hard floors should be reduced and permeable surfaces should be created or green areas should be increased to prevent the temperature increase in urban areas. Additionally, the use of vertical gardens and roof gardens should be increased.



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- In regions where the urban heat island is very high, light-colored materials should be used to reflect the sun's rays.
- Sky visibility should be reduced by increasing planting efforts in the city, and overheating at street level should be prevented by the shading function of trees.

2. CONCLUSION and RECOMMENDATIONS

Thermal comfort is an element that should be taken into consideration in today's city planning. Planning and designs made in cities by taking thermal comfort into consideration are for the citizens to live more comfortably and healthier. Planners and designers, that is, us, have a great responsibility in ensuring this. The most important point that planners and designers should know is that each living space has its own specific climatic conditions and that the climate factor must be taken into account first in the planning to be made. In addition, the identity and natural structure of the city should also be taken into consideration. It should not be forgotten that when wrong planning and design decisions are made, it causes the formation of urban heat islands, which is one of the reasons why people feel uneasy. More attention should be paid to the points mentioned above to prevent the creation of areas that are not suitable for comfort, which increases the level of dissatisfaction among urban residents.

As a result of Turkey's geographical location and landforms, it has many complex climate types. Due to Turkey's complex climate types, cities will be negatively affected, especially due to global warming. In order to reduce this effect, designing urban green areas with urban comfort in mind will increase the living comfort of the city.

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**THE IMPORTANCE OF WALKABILITY ON UNIVERSITY CAMPUSES IN THE
CONTEXT OF SUSTAINABLE CITIES AND COMMUNITIES**

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ABSTRACT

One of the biggest causes of global climate change is the rapidly growing cities in order to meet the increasing population. Due to urban sprawl and increasing automobile use in these cities; carbon footprint increases, agricultural and forest areas are destroyed, water resources, natural environment and air are polluted. This causes irreversible climate disasters. In order to learn from climate disasters and to take precautions against new disasters, studies are carried out in the context of "sustainable cities and societies" from the individual level to the national level. "Walkability" is a basic concept for ensuring sustainability in cities. Walkability is a concept that has gained importance especially with the recent Covid-19 pandemic in order to prevent the negative effects of urban sprawl, suburbanization, expanding road network and increasing vehicle ownership in cities and to provide a "pedestrian-oriented design" approach in cities. During the pandemic period, the importance of walking at every walkable distance and the necessity of designing compact cities that can be walked within 15 minutes have emerged. University campuses with the characteristics of a small compact city; it combines different functions such as work, accommodation, recreation, education, health and sports areas. Therefore, people of various profiles spend time in these areas during the day, participate in different actions and activities, and pedestrian mobility occurs within the campus. For this reason, it is important to investigate the walkability on campus campuses. In this study, it is aimed to explain that sustainable urban life can be achieved with walkability in university campuses, which are small compact living spaces with common areas.

Keywords: Sustainability, Walkability, University Campus, Accessibility, Climate Change.

1. INTRODUCTION

Uncontrolled growing cities, at the expense of destroying green areas, agricultural and forest areas in order to quickly solve the housing problem in increasingly crowded cities, is one of the biggest causes of global climate change. The change in consumption styles compared to the past, such as people's tendency to use individual vehicles, also increases the rate of environmental pollution in cities. These changing consumption patterns not only cause air pollution or health problems, but also cause the world community to face new problems such as global climate change due to the increase in carbon footprint. The main reason for these problems is that people think that the natural environment and resources in the world are infinite, and the way they live their lives uses these natural resources in an unsustainable way.



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After many years of unconscious use of resources, societies have realized that these resources in the world are limited. As a result, the Brundtland (Our Common Future) Report (1987) and the subsequent Rio Summit and Agenda 21 (1992), the UN Conference on Human Settlements-Habitat II (1996) introduced the 'sustainable development' approach, the UN Millennium Summit (2010), Rio A sustainability approach that balances the protection of the natural environment and ensuring social development was also proposed at the +20 Summit (2012) conferences (Anonymous, 2012a).

In order to cope with the poverty, inequality, disease, hunger and climate change that people face today, the United Nations Sustainable Development Conference was held in 2012 and measures aimed at sustainable development were determined. The "Future We Want" document, signed by 193 member countries of this conference and containing 17 targets to eliminate poverty in the world, protect the world and ensure that people live in prosperity by 2030, came into force in 2016 (Figure 1). The goals included in the document called The Future We Want are; ending hunger, reducing poverty, ensuring a healthy life, eliminating economic inequality, sustainable energy use, sustainable architecture and urbanization, renewable production and consumption, and combating climate change (Anonymous, 2012a).



Figure 1. 17 Goals of sustainable development

In this study, the "Sustainable Cities and Communities" target, which is the 11th of the 17 goals of sustainable development, will be examined. Within the scope of this purpose, the points that need to be taken into consideration in urban planning to ensure sustainability in cities will be emphasized. In order to develop the understanding of sustainability in cities, the environmental, social and economic dimensions of sustainability must be addressed together and a holistic approach is required.

Environmental dimension of sustainability;

Environmental issues that need to be addressed in terms of sustainability are resource use, energy, water, waste, urban nature and environmental justice (Grove, 2009). Resource use is



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the first dimension of environmental sustainability (Nijkamp and Opschoor), and the sustainability of resources depends on the sustainability of the city's production and consumption processes. In order to ensure environmental sustainability, attention will be paid to issues that will support the preservation of balance in nature, such as protecting biodiversity, using renewable resources, using environmentally friendly technologies with a zero waste and emission target, and supplying environmentally friendly products.

The basic principles of environmental sustainability can be listed as follows

Table 1. Environmental sustainability criteria (Moldan vd., 2012):

Environmental Sustainability Criteria	
Effective use of climate data	Climate data should be used in the planning and design of campuses in a way that will save energy.
Using non-renewable resources efficiently	Natural resources such as existing vegetation, streams, flora and fauna should be protected and used.
Energy and Waste Recovery	The use of renewable energy sources should be prioritized. Wastes such as paper, metal and glass should be separated on site and recycled and put into use. (Atıl, Gülgün and Yörük, 2005).
Effective Use of Topographic Data	Infrastructure and superstructure problems arising from the land should be minimized. In addition, erosion controls should be carried out, the land structure should be protected, a good planning should be made to meet the needs of all the structures to be built, pedestrians, all vehicle users and cyclists should be considered by paying attention to the adequacy of transportation routes within the land, the land habitat should be protected, a suitable environment should be created for the cultivation of natural species, and finally Control and use of water coming from rainfall should be ensured.
Use of Natural Vegetation	Expenses such as irrigation, disinfection and maintenance should be reduced by paying attention to the use of natural species of the region in the planting works to be carried out in the area.

Economic dimension of sustainability;

In order to ensure economic sustainability, it is possible to ensure that the services provided to the society are based on nature protection, that the continuity of goods and services is ensured, and that resource efficiency is within natural limits (Yazar, 2006). To put it more clearly, renewable energy should be used, recycling and recovery principles should be adopted, public transport-oriented transportation should be increased, and ecology-based production should be expanded.

An ideal and sustainable economy is one that provides the highest amount of general welfare by using the least amount of resources and ensuring the lowest level of environmental damage. To be truly economically sustainable, the overall demand for natural resources must be less than nature's supply of renewable resources (Anonymous, 2023).



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Social dimension of sustainability;

Sustainability represents a social ideal as well as a concrete goal in terms of physical structure (Whitehead, 2003). Socially sustainable basically refers to projects that support the development of society by contributing to it. In this context, it can be observed that in a socially sustainable city, the quality of life is high, there are no discriminations, there is high human interaction and cultural development (Bramley and Power, 2009). In order to ensure social sustainability;

- Ensuring social integration,
- Health
- Access to public green areas and services,
- Nutrition,
- Sufficient housing stock,
- Transport,
- Education,
- Cultural services

are individual needs that must be met (Moldan et al., 2012)

It is seen that the environmental, economic and social dimensions of sustainability mentioned above are related to the subheadings of the "Sustainable Cities and Communities" target, which is the 11th goal of the "Future We Want" document. When we look at these related subheadings, we look at accommodating the increasing population, designing urban transformation in a renewable and environmentally friendly way, reducing environmental impacts in cities, reducing the negative effects of natural disasters, providing access to these areas by including more green and public areas in designs, resource efficiency and It can be seen that issues that will help develop the concept of sustainable cities by implementing policies to reduce disaster risk and protecting the world's cultural and natural heritage are discussed (Figure 2).



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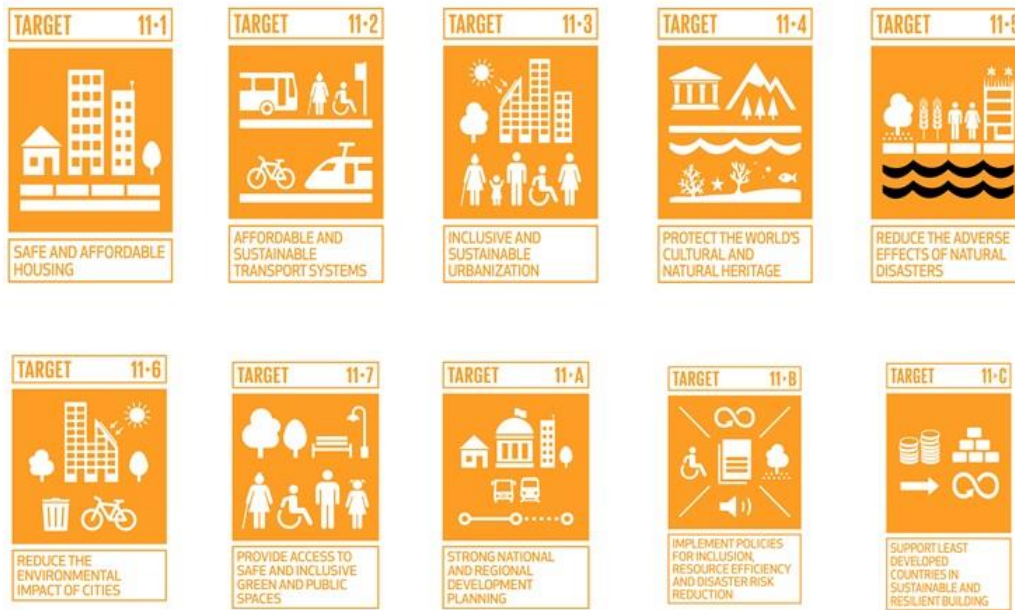


Figure 2. Goal 11 of sustainable development (Anonymous, 2012a)

The 11th goal of Sustainable Development is based on making residential areas inclusive, safe, durable and sustainable. In fact, cities and people are at the center of these goals. The biggest action that brings cities and people together is walking. Walking is a form of transportation that people use to meet their daily needs, go to work, school or parks, reach their destination or go to public transportation stops for a long-distance journey. This form of transportation is a part of our daily life, and when the physical environment allows walking, it creates walkable environments. The main purpose of walkable environments is to encourage people to walk and thus ensure sustainability in cities.

Walking and walkability are most important for the sustainability of natural and environmental resources. Walking is a clean form of transportation and helps reduce air pollution. In addition, the use of walking as a form of transportation enables cities to move away from the automobile-dependent setup (Yazıcıoğlu Halu, 2010). Thus, energy consumption, fossil fuel use, air pollution and carbon emissions in cities are reduced. Additionally, distances between destinations are close due to the compact design in a walkable environment. Having residences, workplaces, shopping, schools and entertainment areas close to each other prevents urban sprawl and sprawl; It prevents the destruction of fertile agricultural lands, wetlands and forest areas. The basis of all these environmental benefits is the increase in walkability and the resulting change in the urban development model (compact urban development model). For this reason, improving walkability is directly and indirectly beneficial in combating climate change.

Walkability also ensures economic sustainability as it creates pedestrian mobility and increases the efficiency of commercial activity. Since walking is a cheap form of transportation, it provides economic benefits for the individual. In addition, the time spent in walkable environments increases and therefore the money spent increases; Thus, the efficiency of urban commercial activities increases.

Walkability is a socially fair means of transportation that does not create class discrimination because it is open to the whole society (Forsyth & Southworth, 2008). In this respect,



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walkability has public benefits such as ensuring social justice and eliminating social segregation. Walkability enables citizens to be included in urban life and at the same time provides many social benefits to the city.

Walkable environments are important for the sustainability of human health, the natural environment, the global economy and social structure. Walking is beneficial for the physical and mental health of individual people. The sustainability of walkability on human health emerges here. It has been scientifically proven that people who make walking a form of transportation and walk regularly are less exposed to chronic diseases such as obesity, hypertension, diabetes, cardiovascular disease and depression. It is also known that as walking and walkability increases, individual vehicle use and therefore air pollution decrease. Thus, the incidence of respiratory system disorders such as asthma caused by air pollution also decreases.

The issue of walkability has been brought to the agenda in terms of individual health during the Covid-19 epidemic and its importance has been re-understood. In this process, people spent time in public spaces where they could feel safe in terms of health, paying attention to both social distance and hygiene conditions. Additionally, individual modes of transportation were preferred to maintain social distance during this process. During this period, private vehicles were used for long distances as a mode of individual transportation; In close distances, transportation is possible on foot or by bicycle. For this reason, in this process, in order to increase walking and reduce carbon emissions, the concepts of "pedestrian-oriented design", "walkable cities" and "15-minute cities" have come to the fore and exemplary cities have been designed. One of these cities is Melbourne.

According to the target set for the city of Melbourne, each neighborhood will be able to reach all the units it needs within 800 meters, that is, a 20-minute walk. To achieve this goal; providing safe, accessible and well-connected spaces for pedestrians and cyclists, providing high-quality public spaces and open spaces, providing services and destinations that support local life, facilitating access to public transport connecting people to urban services, providing housing/population at appropriate densities that make local services and transport viable and strategies such as supporting developing local economies have been developed (The State of Victoria Department of Environment, Land, Water and Planning, 2019). In addition to Melbourne, many cities such as Paris and Shanghai have adopted the 15-minute city concept. In 15-minute neighborhood units, it is aimed to design many functions in people's daily lives, such as housing, education, health, work, shopping, entertainment and green areas, together and to be located within walkable distances.

At the heart of such walkable cities is a pedestrian-oriented urban design approach, and in this approach, priority is given to pedestrians and pedestrian areas. This approach includes many goals that separate pedestrians from vehicle traffic, encourage them to walk at walkable distances, and enable pedestrians to use public spaces not only to meet their essential needs but also to socialize and spend time. Another goal of the pedestrian-oriented design approach is the integration of pedestrian access networks with different transportation modes (tram, bicycle, bus, etc.). Thus, when the pedestrian wants to reach long distances, he will be able to find many modes of transportation that he can easily access and use on his own route.

In walkable cities, pedestrian spaces must meet walkable environmental criteria. Walkability is the degree to which the built environment supports and encourages walking by providing pedestrian comfort and safety, connecting people within a reasonable amount of time and effort,



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and providing visual interest during the journey through the network (Southworth, 2005). As can be understood from this definition, walkability depends on the physical characteristics of the built environment. These qualities determine the walking demand for pedestrian space by affecting pedestrians' perception and walking preference. There are various definitions for these qualities by different authors. A literature review about the physical characteristics that a walkable environment should have is given below.

According to Dovey and Pafka (2020), the realization of walkability in urban space depends on DMA, that is; It depends on density, functional mix and access. Densities of buildings and people, the mix of different functions and attractions (places of interest), and the access networks we use to navigate between them are the basic tools of walkability.

In 2005, Alfonzo conducted a study in which he revealed the factors affecting walking behavior and the parameters affecting a person's decision to walk, and based on this study, he created a walking needs hierarchy model. This model suggests that there are five levels of needs that relate to urban form and are taken into account in walking decision-making. These; feasibility, accessibility, safety, comfort and pleasurability. There is no dominant need in this five-step hierarchy of needs created by Alfonzo, but each need is directly linked to the previous and next steps.

Another study to define a walkable environment was conducted by Ann Forsyth. Forsyth (2015) generally associates walkability with the physical environment and argues that a walkable environment should have four basic qualities: passable, compact, safe and physically attractive.

As mentioned above, these physical qualities can be questioned in settlements where there are campuses, neighborhoods, public spaces, pedestrian areas and mixed use of land within a 15-20 minute walking distance (within an average distance of 500-800 meters). At this point, university campuses, which are found in almost every city in our country, appear as small city models. University campuses host many different units and various social, cultural and sports activities within their large areas; ensuring integrity between buildings and open spaces; Since they have versatile functions such as allowing space use with outdoor arrangements, they form small city models in themselves. For this reason, the sustainability of university campuses through walkability will be discussed within the scope of the study.

2. DISCUSSION and SUGGESTIONS

According to the literature review, the "Sustainable Cities and Communities" target, one of the 17 Sustainable Development Goals; It includes studies that focus on humans. In this pyramid, whose cornerstone is people, individual, social and global changes can occur respectively. In other words, when individual sustainability is achieved, societies and cities develop and become sustainable. In order to increase individual sustainability, people should actually be on foot and walking in cities; It directly affects the physical, social, cultural and community life of cities. In this respect, it is important to investigate this effect in certain urban areas within cities. University campuses, which are a part of cities and contribute to the scientific development of the society, are important living spaces that need to be addressed in terms of sustainability and walkability.

Apart from the basic functions of education and research, universities also provide services as required by today's conditions; working, accommodation, eating, drinking, shopping, entertainment, sports, recreation, health, etc. They are campuses that have physical qualities to



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meet many functions (Büyükşahin Sıramkaya & Çınar, 2012). In these campuses, there are planning criteria for common use spaces where staff and students from all institutions in the university can come together and exchange ideas. One of these criteria is to associate these functions mentioned above, create a systematic order and ensure that they work as a whole. At this point, the urbanism principles of walkability and sustainability need to be addressed in a holistic manner.

3. CONCLUSION and RECOMMENDATIONS

Achieving urban sustainability in university campuses is possible based on walkability and criteria. According to the literature review, for a campus to be walkable; first of all, it must be passable or walking action is possible. In other words, pedestrians should be able to reach the destinations they want to reach within the campus by walking, and the path should be suitable for walking. For this purpose, activities and units within the campus must be within walking distance of the residences or dormitories where pedestrians live, and the walking path must be allocated to pedestrians. Thus, every activity within a walkable distance encourages walking and contributes to the reduction of private vehicle use and therefore carbon emissions.

Secondly, in order for the campuses to be walkable, the campuses are compact; In other words, the functions within the campus should be intense and diverse. Since university campuses are developed within areas with certain boundaries, they are prone to the compact development model. And according to this development model, functions within campuses should generally be diverse and intense. Faculties, residences, sports complexes, health units and markets within the campuses should be designed close to each other and at walkable distances. Thus, pedestrians will be able to meet all their needs in areas close to each other and choose to walk to every destination they want to reach. Thus, urban sprawl will be prevented and the damage to nature and the damage caused to the environment due to the use of private vehicles will be reduced.

Another criterion for campuses to be walkable is physical accessibility. For this reason, human scale and pedestrians should be the priority within the campus. When pedestrians are mentioned, people walking may come to mind; However, disabled individuals and disadvantaged groups such as the elderly, children, etc. everyone should be considered on foot. For this reason, there should be special paths for every pedestrian within the campus; Pedestrian and vehicle traffic should be separated and, if possible, bicycle and public transport paths should be designed separately from private vehicle paths. In addition, all pedestrian access networks for pedestrians must be accessible to every activity and public transportation stops within the campus. Thus, there will be a mode of transportation that can be used by people from all walks of life, and people from all profiles will be able to access the function they need; The campuses will be places with high pedestrian accessibility, accessible by all segments of society and therefore preferred.

Another criterion for walkability is safety. The perception of security in campuses depends on factors such as high illumination at night, eliminating negative physical conditions related to comfort (shade, sun, rain, wind, etc.) and creating areas separated from vehicle traffic. Campuses are public spaces that are used actively throughout the day, thanks to their spatial diversity (Tatal, 2018). In order for these places to be safe, they must be alive at night as well as during the day. For this reason, pedestrians should be encouraged to use these spaces actively throughout the day. To achieve this, campuses must have good night lighting and the number



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of activities suitable for night use must be high. Thus, social vitality and preferability will be ensured in the campuses.

Another criterion for walkability is comfort and, accordingly, satisfaction. Comfort refers to a person's level of comfort and satisfaction. Comfort criteria depend on many factors such as sun, shade, wind, landscape, climatic conditions, weather, urban design elements that provide protection from adverse or extreme weather conditions, and street furniture that provides convenience in urban spaces. To ensure this, according to Alfonzo (2005), the relationship between pedestrian and vehicle traffic should be balanced; The presence of traffic calming elements, speed limiters and buffers should be auditable; The status of the pedestrian crossing system should be shaped according to the urban form; pavement widths must comply with standards and pavement maintenance must be carried out regularly; Urban design elements such as canopies and passages that provide protection from adverse or extreme weather conditions and street furniture that provide convenience in urban spaces should be designed.

Finally, according to the literature review, it is important that campuses are attractive for walkability and provide visual interest to pedestrians while walking. A place that is physically attractive for this; It must provide a physical infrastructure, including wide and well-maintained sidewalks, lively street frontages, traffic calming measures, street trees and planted buffers, marked and signalized pedestrian crossings, benches, wayfinding signs and pedestrian-scale lighting. Thus, a physically attractive place is interesting, arouses curiosity and encourages people to walk. People walk because they want to see that place, not because they have to.

When the physical walkability criteria mentioned above are met, the walkability and therefore sustainability of university campuses will be ensured. Sustainability is a form of urban intervention that begins in urban areas such as universities or even at the street scale. Although sustainable development goals include upper-scale decisions, they also include decisions based on the street and human scale. In this study, walkability criteria that should be taken into consideration in university campuses, which are a small part of a city, are mentioned and suggestions are made. If university campuses are designed in line with the walkability criteria that should be taken into consideration in urban planning; It will contribute to urban sustainability with these design criteria.

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**INVESTIGATION OF HACI ALI AĞA MANSION IN THE CONTEXT OF
RESEARCHING TRADITIONAL SILLE HOUSES IN TERMS OF PLAN AND
MATERIAL**

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ABSTRACT

Unique memory and local architectural understanding, have been transferred to the present throughout the history and bring the rural architectural heritage to the agenda. In this sense, Sille archaeological and urban site standing out with its historical settlement is noticed with its natural heritage and the historical urban pattern created by its traditional architectural heritage in Konya which is hosted many different civilizations throughout history. In this study, the architectural features of the house numbered 1-3, which is located on Hacı Ali and Nalpınar Streets, the remarkable streets of city of Sille, and dated back to the beginning of the 20th century with its traditional Sille house style and registered style, have been evaluated by focusing on the heritage from the past to the future. Therefore, it is aimed to understand the importance of this vernacular architectural heritage knowledge formed by the preservation of traditional houses by examining it with many parameters such as architectural features, spatial organization, material properties and with the information of its belonging to Hacı Ali Ağa, who gave his name to the street in the south of the house and had this house built for him.

Keywords: Konya/Sille, Traditional Housing, Rural-Vernacular Architecture, Architectural Heritage.

3. INTRODUCTION

Throughout history, humans have formed various living units to meet their basic life requirements such as nutrition and shelter. In the early periods, these living units were often created by utilizing natural elements like caves, but over time, humans developed their construction abilities, transitioning to settled life and starting to construct their own structures tailored to their needs. These structures not only fulfilled the basic needs of humans but also evolved into spaces reflecting their social and cultural needs. Over time, units of life such as streets, squares, and neighborhoods came together in a certain order to form larger settlements, becoming spaces where cultural and architectural connections were established. It can be said



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that traditional Turkish houses bear traces of these settlements created in this context. Similarly, the use of flat roofs, among other architectural features, in the Çatalhöyük settlement, which dates back 7,500 years in the southeast of Konya province, along with its other similar architectural characteristics and its location on a circulation axis, serves as evidence that these architectural features had an influence in various regions of Anatolia (Kuban, 1995; Bektaş, 1996).

The topography and climatic conditions of Anatolia are among the factors influencing housing design. The stages that affect the architectural character, such as construction techniques, materials used, and facade designs, have been shaped under the influence of the region's geographical and climatic characteristics. Additionally, factors such as the regions economy, culture, and lifestyle have also influenced architectural design. The combination and interaction of all these factors have resulted in different architectural outcomes in various regions of Anatolia. These diverse architectural outcomes have enriched local architecture and added unique value to the regions (Küçükerman, 2007).

The formation of the characteristic features of traditional Turkish houses can be traced back to many years ago, and it is understood that the general characteristics of these houses have evolved over time as a result of accumulated cultural heritage and experiences. In this context, the emerging vernacular heritage, also known as traditional-rural architecture, plays an important role in transferring knowledge from the past to the present, depending on experiences, regions, and needs (Gül, Bostan & Akın, 2019; Canan, Kobya, Aköz & Temizci, 2020).

Within this framework, the concept of preservation emphasizes the need to protect all forms of cultural assets, created by human hands and natural elements, as unique and irreplaceable, in order to pass them on to future generations. This vernacular-rural heritage is seen as an accumulated treasure of knowledge and experience, and it is emphasized that this heritage can be used as a valuable and important resource (Yaldız and Asatekin, 2016).

Traditional Turkish House and Architectural Features

The Traditional Turkish House, with its origins tracing back to Anatolia and subsequently developing distinctive characteristics under the dominion of the Ottoman Empire, represents a house type rooted in a rich historical heritage (Eldem, 1995). The emergence of this architectural tradition was significantly influenced by numerous factors such as climate and geography, leading to variations in the traditional Turkish house concept across different regions of Anatolia (Sezgin, 2006). Cengiz Bektaş (2001) delineates ten fundamental principles that constitute the essence of the Turkish house (Table 1).

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Table 1. The principles underlying the turkish house (Bektaş, 2001)

Number	Principles That Form the Traditional Turkish House
1	Suitability for Life, Nature and Environmental Conditions
2	Design Based on Realism, Rationality, Desires and Needs
3	Inside Out Solution
4	Internal-External Harmony
5	Frugality
6	Convenience Principle
7	Sizes Suitable for the Human Body
8	Climate Suitability
9	Choosing the Equipment Closely
10	Flexibility

One of the most distinctive and noteworthy features of the traditional Turkish house's architectural concept is the transformation and integration of rooms with a central space called 'sofa.' Different floor plan schemes can be observed, including those without a central sofa, with external sofas, and with internal central sofas. Traditional Turkish houses are typically constructed as single-story or two-story buildings. In two-story traditional Turkish houses, the lower floor typically consists of service areas or production units such as storage rooms and haylofts, while the upper floor serves as the main living unit. Another striking characteristic of Turkish houses is their design process, which is conceived from the inside out. This design approach aligns with the principle of form following function, as seen in modern architectural movements. Inside traditional Turkish houses, interior features include cabinets used for storage and decorative niches. These elements not only serve functional purposes but also contribute to the visual expression of the spaces through their craftsmanship in woodwork (Eldem, 1995; Uşma & Urfalıoğlu, 2018; Bektaş, 1996; Özcan & Güngör, 2019). (Figure 1).

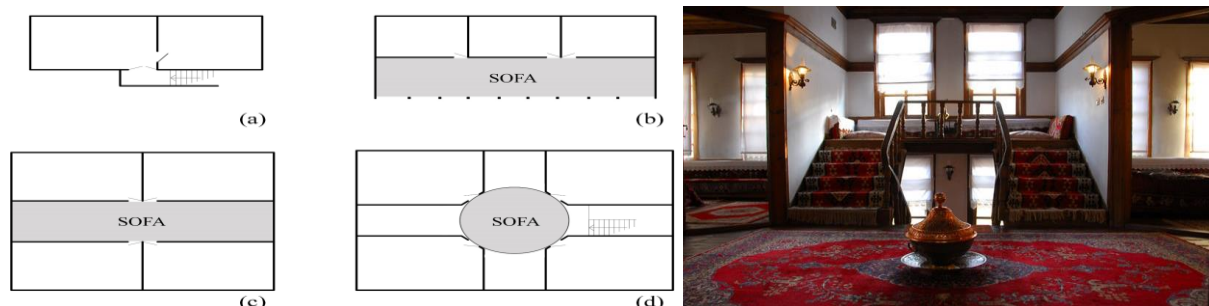


Figure 1. Examples from the traditional Turkish house plan scheme a) Plan type without sofa b) Plan type with outer sofa c) Plan type with inner sofa d) Plan type with middle sofa (According to Sedad Hakkı Eldem) and spaces specialized with the use of sofa (Binay, 2021)



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In terms of construction techniques, the Traditional Turkish house commonly employs the use of wooden framework infilled with mudbrick or 'bağdadi' construction method. These construction techniques may vary depending on the size and ornamental features of the structures. The primary construction materials in Traditional Turkish houses consist of locally sourced materials such as wood and stone. In regions dominated by the Anatolian steppe, adobe, commonly known as 'kerpiç,' is preferred as a building material (Sezgin, 2006). (Figure 1 and Figure 2).



Figure 2. Examples of Traditional Turkish Houses from different regions are the Kütahya house example (Bektaş, 1996), the Safranbolu house example (Küçükerman, 1985), the Kayseri Erkilet house example (Bektaş, 1996), and the use of materials specific to the region and construction techniques

In the arrangement of facades in traditional Turkish houses, doors and windows play a significant role and are tailored to their environmental context, often featuring prominent wooden doors and windows. Some design solutions exhibit a tendency to open towards the external environment, the street, or the exterior of the building, highlighting the concept of projections that define the facade typology in traditional Turkish houses and establish a connection between the interior dwelling and the outside world. These projections, known as 'cumba' in some regions of Anatolia, are designed to extend the available space by projecting outward, particularly on upper floors (Özcan & Güngör, 2019). (Figure 1 and Figure 2).

4. MATERIALS and METHODS

The scope of this study revolves around contributing to the characterization of the traditional architectural fabric of Sille through the examination of specific parameters, such as land use and orientation, material usage, construction techniques, structural elements, architectural components, facade typology, space organization, and interior features. The study focuses on House No. 1-3, also known as Hacı Ali Ağa Mansion, located on Hacı Ali Ağa Street and Nalpınar Street within the historical center of Sille. This research aims to shed light on the reflection of architectural heritage from the past, emphasizing the importance not only of preserving this heritage but also of utilizing this vernacular architectural legacy.

The methodological framework of this study comprises four distinct phases. In the first phase, the focus was placed on the concepts of rural-traditional heritage and cultural heritage. The second phase involved the architectural definition of the Traditional Turkish House in terms of its functionality and spatial characteristics. The third phase, designated as the 'Findings and Discussion' section, entailed an examination of the study area, Sille town, and its present-day condition. Within this section, attention was directed toward Sille's urban settlement and the traditional residential fabric as a subtopic. In another subheading, the architectural features of Hacı Ali Ağa Mansion were scrutinized within specified parameters. The overarching objective



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of these stages was to document the vernacular wisdom reflected in the traditional residential architecture of Sille, with the intention of passing it on to future generations. Furthermore, it is envisioned that this study will serve as a foundational reference for future research endeavors.

The literature review section of this study has been meticulously constructed, with a comprehensive approach. To achieve this, an extensive review of resources was conducted, encompassing master's theses, doctoral dissertations, and scholarly articles. Internet-based research methods were employed to gather diverse sources of information. Furthermore, various visuals, periodicals, books, documents, user-generated videos, surveys, and institutional reports were scrutinized in alignment with the objectives of this research. An archival search was conducted specifically for Sille urban settlement, wherein data related to projects, plans, drawings, survey-restoration efforts, preservation initiatives, and analyses, including Conservation-Oriented Zoning Plans, as well as various maps and photographs, were sourced from official institutions. On-site inspections of local examples allowed for direct observation of the surroundings and area analysis. The process was further enriched through on-site photography, contributing to the overall research endeavor.

5. FINDINGS and DISCUSSION

a. Field of Study and Its Current Situation

Within the scope of this study, the historical settlement of Sille, located approximately 10 kilometers from the city center of Konya in the Central Anatolia region of Turkey, was selected as the study area. This choice was made with a consideration of the rapidly changing environmental conditions affecting residential architecture, highlighting the traditional-rural architecture prevalent in the region. (Figure 3 and Figure 4).

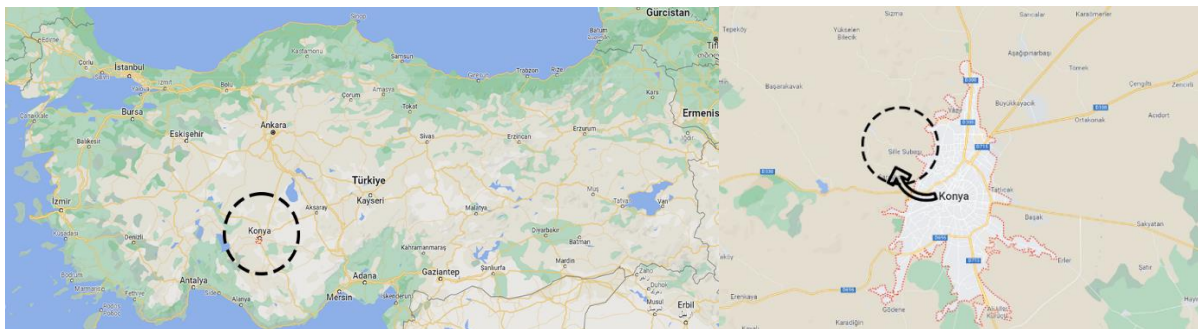


Figure 3. Location of Sille city on Turkey map (Google Maps, 2023)ve **Figure 4.** Location map of Sille city (Google Maps, 2023)

The historical settlement of Sille has been a host to various civilizations throughout history and has emerged as one of the prominent urban areas today, owing to its rich natural heritage and historical fabric. Sille's historical urban settlement, with its amalgamation of traditional memory, urban identity, and regional lifestyle, along with its unique architectural approach, has the potential to transform the region into a focal point. (Kuyrukçu & Kuyrukçu, 2015; Aklanoğlu and Erdoğan, 2011).

Due to its historical identity, traditional architectural heritage, cultural and natural riches, the historical settlement and urban fabric of Sille have been deemed worthy of preservation. For this purpose, in 1995, a decision was made by the Konya Cultural and Natural Heritage Protection Board to declare the southern slopes of the old ancient settlement area in Sille as a

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1st Degree Archaeological Site, while the main settlement area was designated as an Urban Conservation Area. Additionally, in 2001, a Conservation-Oriented Zoning Plan was completed as per the Protection Board's decision (Aklanoğlu and Erdoğan, 2011; Sille Street Rehabilitation Survey Report, 2014). (Figure 5, Figure 6, and Figure 7).

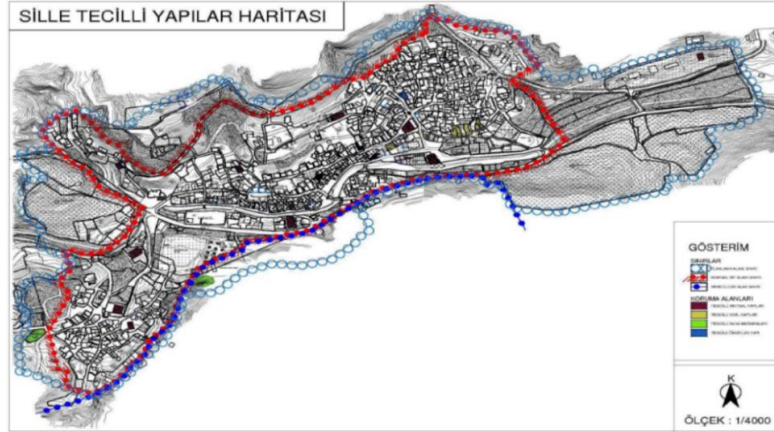


Figure 5. Sille registered buildings map and representation of urban-archaeological protected areas (Çiçek, 2010)

Sille has been designated as both an archaeological and urban conservation area, a decision regarded as a significant step in the context of sustainable tourism. This measure not only contributes to the preservation of the region's cultural and historical treasures but also fosters the development of sustainable tourism activities. (Kuyrukçu & Kuyrukçu, 2015; Aklanoğlu and Erdoğan, 2011; Sille Street Rehabilitation Survey Report, 2014). (Figure 6).



Figure 6. Sille conservation zoning plan (Sille Municipality Culture and Tourism Archive) and **Figure 7.** Sille site impact transition area (Sille (Subaşı) Neighborhood Conservation Implementation Zoning Plan Study 1/1000 Scale Conservation Implementation Zoning Plan Explanation Report, 2022)

Presently, restoration and street rehabilitation projects are being carried out in the historical settlement of Sille in accordance with Law No. 2863 on the Protection of Cultural and Natural Assets. These initiatives aim to maintain a balance between the preservation and utilization of



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Sille, thereby contributing to the promotion and sustainable development of the town. Furthermore, the Sille urban settlement is included in the master plan of Konya Municipality, aligning with efforts to support the future development and organization of Sille (Solak, 2016).

b. Sille Historical City Settlement and Traditional Housing Texture

The settlement area of Sille, distinguished by its rich historical and cultural identity, has been known by various names throughout different periods, owing to its history of coexistence of diverse beliefs and cultures and hosting numerous civilizations. It carries a significant vernacular architectural heritage within its boundaries. This area serves as a bridge between the past and the present, functioning as a micro-level cultural tourism corridor within the Konya province and on a broader scale, as a national and international cultural tourism corridor. (Sönmez, Sadıklar, K. Torun & Torun, 2017; Erdem, Yıldırım, Çiftçi, Dülgerler, Çıbıkdiken, Levend & Erdoğan, 2010). (Figure 8).

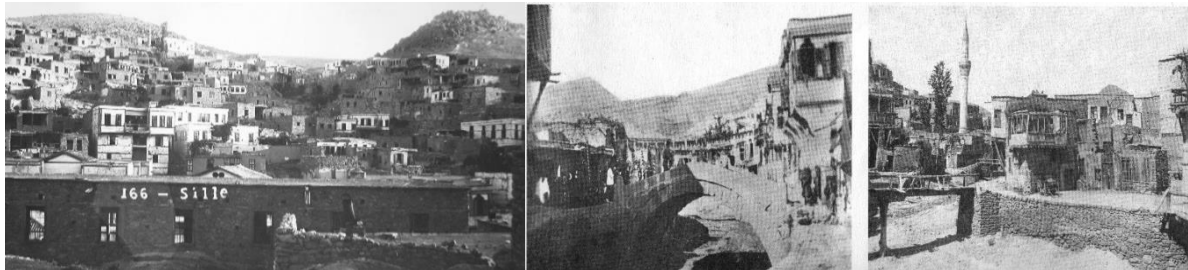


Figure 8. View of Sille at the beginning of the 20th century (Selçuklu Research Center Archive)

Among the factors that played a crucial role in shaping the traditional urban fabric of Sille, the topography of the terrain stands out as a primary influence. The urban structure of Sille is situated on steeply sloped terrain. The presence of this sloped terrain has significantly impacted the settlement's character, necessitating architectural adjustments to accommodate the hilly and steep terrain. In particular, buildings, streets, and the urban fabric have been organized in a terraced manner to adapt to the topography. The passage of the Giret stream, a water source, through the area has facilitated a gradual elevation on the southern slopes of the buildings, streets, and inner neighborhoods. This architectural arrangement not only harmonizes with Sille's topography but also provides visual aesthetics and functionality to the structures. (Tapur, 2009; Akınoğlu & Erdoğan, 2011; Közoğlu, Canan, & Korumaz, 2022). (Figure 9).



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Figure 9. Sille city settlement and topography (Sille Municipality Archive)

Another significant factor contributing to the formation of the traditional urban fabric of Sille is the continental climate, characterized by dry and hot summers, as well as rainy and harsh winters, along with the locally sourced building material known as Sille stone, also referred to as 'kan stone.' This material is integral to the region's specific construction techniques, particularly the rubble masonry construction method. Sille stone, a regional material, is extracted from quarries in the vicinity of Sille and is extensively used in the area. It is a preferred material in various types of structures and serves as a crucial component in the regional architecture. Employed in conjunction with traditional construction techniques, Sille stone holds a prominent place in the urban silhouette, imparting a distinctive identity to Sille's architecture and reflecting the experiences of vernacular architecture (Aklanoğlu, 2009; Öksüz & Bollukcu, 2021). (Figure 10).

The Turkish civilian architectural examples in the Sille urban settlement and its surroundings were predominantly constructed during the late 19th and early 20th centuries. These architectural specimens are observed to have evolved through interactions with the region's local culture, traditions, climate conditions, and topographical factors. Furthermore, it is evident that the functionality of the structures in Sille's urban settlement is emphasized, as they are designed on a small scale. These buildings are known to be constructed using traditional, indigenous materials such as Sille stone, wood, adobe, and earth (Aklanoğlu, 2009; Közoğlu, Canan, & Korumaz, 2022). (Figure 10).



Figure 10. View of narrow stone-paved Sille streets and Sille urban settlement (Sille Municipality Archive; Taş, 2013 and Ertaş, 2016)

The traditional Sille houses constitute one of the sub-scales that shape the Sille urban fabric and play a significant role in regional architecture. These houses have achieved their distinctive architectural identity through the skillful use of local materials, particularly Sille stone.



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Traditional Sille houses, in addition to Sille stone, reflect the prominent characteristics of the region's architecture through the use of materials such as wood, stone, adobe, and iron, as well as their craftsmanship. Furthermore, Sille traditional houses share similarities with urban-scale Turkish houses that prioritize functionality in their design (Közoğlu, 2019; Közoğlu, Canan, & Korumaz, 2022).

Sille houses, constructed in harmony with the region's topography, are typically designed as two-story buildings with single or double-door entrances. While the traditional Turkish house plan type predominates in the upper floor, it is evident that this design approach varies in the lower floors. The primary living spaces of the house are usually located on the upper floor, whereas the ground floor commonly contains service spaces such as a stable, hayloft, kitchen, and pantry. Stairs are typically made of wood. The first floor, on the other hand, serves as the area where the sofa and rooms are arranged (B. Erkiş, 2016; Sille Street Health Survey Report, 2014). (Figure 11 and Figure 12).



Figure 11. Two-storey Sille houses and general view of Sille houses (Asilkan and Güneş, 2021)

Sille houses generally reflect the traditional Anatolian Turkish house facade typology and features as their facade concept. Windows, doors, wooden decorations, projections, and metal accessories are prominent elements on the facades. The window placements also mirror the traditional Turkish house window arrangement, featuring long and rectangular windows. Due to the influence of the Greeks who were active in the region for a time, some examples exhibit circular forms. The construction system of traditional Sille houses involves wooden lintel stone walls and the use of rubble masonry. Floors, doors, and windows are made of wood, and flat roofs are preferred (Karpuz, 2000; B. Erkiş, 2016; Sille Street Health Survey Report, 2014). (Figure 11).

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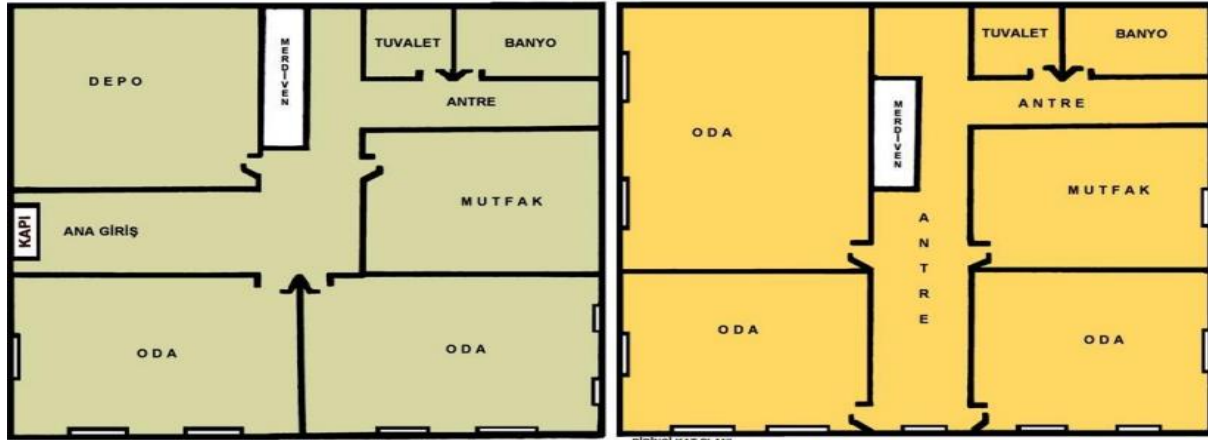


Figure 12. The most common example of traditional housing plan in Sille urban settlement (Tapur, 2009)

In addition, Sille houses feature functional spaces designed according to local characteristics. Examples of such spaces include the guest room known as 'mabeyin,' the spacious courtyard called 'sofa,' the main living area of the house known as the 'hayat' section, the corridor referred to as 'tahtaboş,' and the small secluded room known as 'izbe.' Inside the rooms, wooden decorative elements such as 'yükçük,' 'ağzıaçıklık,' 'çiçeklik,' and carvings have been used. The absence of a sewage system in Sille houses reflects the construction techniques and infrastructure conditions of the past, indicating that water supply was sourced from wells, nearby springs, and fountains (B. Erkiş, 2016; Sille Street Health Survey Report, 2014). (Figure 12).

c. Hacı Ali Ağa Konağı ve Mimari Özellikleri

In the Sille region of Konya province, at the intersection of Hacı Ali Ağa Street and Nalpınar Street, stands the Hacı Ali Ağa Mansion with inventory numbers 1-3, comprising a basement, ground floor, and first floor, typical of the traditional Sille houses built on sloping terrain. Stylistic analysis dates the structure to the early 20th century. The main entrance of the building is located on the eastern side and is accessed through a double-winged door. It is known that in the past, camels used to pass through this large door, and the house is attributed to Hacı Ali Ağa, after whom the street to the south of the house is named. It is also documented that Hacı Ali Ağa had this house built for himself (Figure 13; Figure 14 and Figure 15).



Figure 13. The location of Hacı Ali Ağa Mansion within the building block (Konya Municipality Conservation-Oriented Zoning Plan Building Conditions Brochure) Figure 14.



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Different views of the eastern and southern facades of Hacı Ali Ağa Mansion at various time intervals (Sille Street Rehabilitation Survey Report, 2014)

The structure is privately owned today and is recognized as an authentic example of the architectural style in Sille. Moreover, being a registered building, it is preserved as a cultural heritage. This residence is considered one of the significant structures in the Sille region. Presently, it also reflects the characteristics of a Turkish house in terms of art and architectural history.

The primary material used in the construction of this building is Sille stone, and its roofing consists of a flat earthen roof. The structure is constructed with three floors, including the basement, and is equipped with a balcony extending along the upper floor. This balcony is supported by wooden handrails with wooden support columns. Access to the upper floor from the stone-paved courtyard is provided by a wooden staircase. The upper floor features a plan with an inner living area, and the rooms open up to this narrow, elongated living space. At the end of the staircase providing access to the upper floor, there is a kitchen section. The interior and decorative features of the rooms, while maintaining a simple appearance, include wooden shelves and cabinets, emphasizing woodworking and ornamentation. Wooden cladding is used for the floors of the rooms, and the ceilings are adorned with wooden round beams (See Figure 14 and Figure 15).



Figure 15. The ground floor features a double-winged wooden sentence door of the building, wooden handrails supporting the protrusion on the south facade, and the upper floor's inner living area with rooms (Sille Street Rehabilitation Survey Report, 2014).

Land Use and Orientation

It is observed that the residential units numbered 1-3, located at the intersection of Hacı Ali Ağa Street and Nalpinar Street, which are significant streets in the town of Sille, were designed in accordance with the climate and terrain conditions, aiming to enhance their relationship with the surrounding environment, much like traditional Sille houses. Constructed with vernacular architectural knowledge, the dwelling, like traditional Sille houses, is built in close proximity and in a compact form to prevent heat loss. In this way, an attempt has been made to create a microclimate at the desired level. It is evident that, similar to other traditional Sille houses, the residential unit numbered 1-3 is situated on sloping terrain in a manner that does not obstruct the air, light, and view of another dwelling. This emphasizes the importance of the residence in providing natural ventilation (Figure 16).

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Figure 16. The contiguous layout and orientation of Hacı Ali Ağa Mansion towards the south and east facades (Sille Street Rehabilitation Survey Report, 2014).

The locations of the structures play a significant role in shaping the settlement pattern in the town of Sille, depending on the topography of the land. In this context, residential units numbered 1-3 were constructed in a manner that harmonizes with the terrain by leveraging the land form, much like traditional Sille houses. It is designed in a gradual manner to accommodate the slope of the land, incorporating a basement level that conforms to the incline. Residential unit numbered 1-3 is oriented towards the south and east directions. The entrances to the structure are provided from the eastern facade. It can be observed that in the facades facing south, additional window openings have been created to harness sunlight, striving to passively utilize solar energy (Figure 16).

Spatial Organization and Interior Features

This structure is a three-story residence comprising a basement, ground floor, and first floor. The ground floor of the building follows an inner living area plan, and its square-shaped inner living area is used as a transition point providing access to different rooms and additional functions. The floor of the inner living area is covered with Sille stone, and its ceiling is supported by wooden round beams, a feature commonly seen in traditional Sille houses. The rooms arranged around the inner living area on the ground floor serve various functions. The walls of the rooms are adorned with wooden cabinets and openings, characteristic of traditional Sille houses. The floors of the rooms are wooden clad, and their ceilings are also decorated with wooden round beams (Figure 17 and Figure 18).

The first floor of the structure has a different floor plan compared to the ground floor, and access to the upper floor is provided through the stairwell located on the south facade of the building. Entry to the first floor is gained through a door opening into the inner living area, which extends in a north-south direction. The rooms are positioned in the east and west directions. Similar to the ground floor, the walls of the rooms on the first floor feature wooden cabinets and openings specific to traditional Sille houses. The floors of these spaces are covered with wooden cladding, and their ceilings are adorned with wooden round beams. Colored glass panels integrated into the round-arched windows are used to add movement to the interior of the space. Additionally, in the past, there used to be a protrusion on the southern side of the inner living area, which is now utilized as a balcony (Figure 17 and Figure 18).

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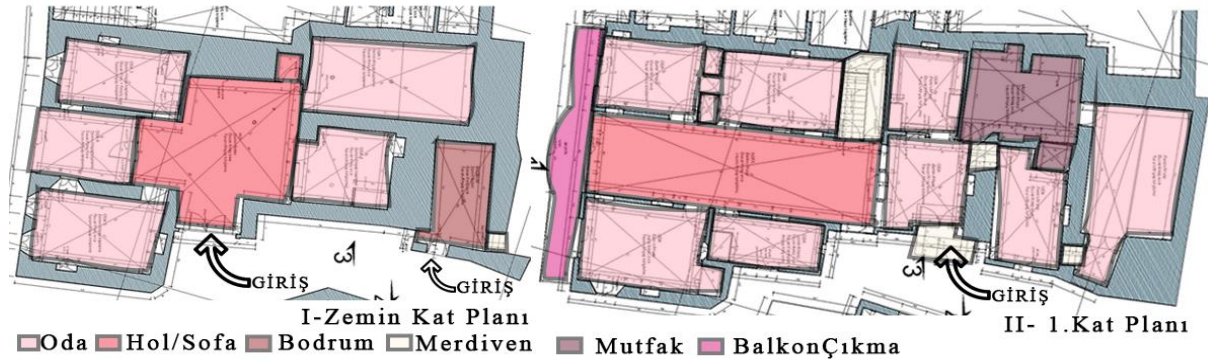


Figure 17. Spatial organization based on the ground floor and first-floor plans of Hacı Ali Ağa Mansion (Figure 17 and Figure 18)

The northern section of the inner living area, extending in a north-south direction, is separated by a three-arched section from the entrance onwards. This design approach is reminiscent of the vestibule areas in Turkish houses and aims to make the space more functional. The floor of the inner living area is covered with Sille stone, and these stones are arranged in an orderly manner, with an octagonal motif in the central section. This motif is typically seen as an ornamentation style in wooden ceilings, but in this house, it manifests itself as an original application made of Sille stone on the floor. The fact that this traditional Sille residence, known as Hacı Ali Ağa Mansion, is adorned with such detailed decorations is believed to be attributed to Hacı Ali Ağa's personal supervision of the construction, indicating that he had it built for himself. In terms of craftsmanship quality, it surpasses other traditional Sille houses and features more elaborate decorations. With these characteristics, Sille Hacı Ali Ağa Mansion constitutes a significant contribution to the region's traditional architectural heritage (Figure 17 and Figure 18).



Figure 18. The interior features and decorative elements of Hacı Ali Ağa Mansion, reflected in the woodworking and cabinets (Sille Street Rehabilitation Survey Report, 2014).

Material Usage and Construction Technique

The fundamental building material utilized in the construction of the structure is rubble stone. Wood and stone materials are prominently featured in the interior spaces. In the design of the outer facade, Sille stone is combined with adobe plaster, and in certain areas, wooden supports are added to ensure the load-bearing capacity of the walls. It has been observed that in recent times, cement plaster has been preferred in some areas. Additionally, in the interior ceiling finishes, apart from wooden round beams, it is evident that covering boards, similar to those on the floor, are employed.

Table 2. Material usage in Hacı Ali Ağa Mansion



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The Use of Materials in Hacı Ali Ağa Mansion

Stone	Wood	Brick	Adobe	Earth	Metal	Concrete

Stone Material

The main construction material of the building is natural stone, and the facades exhibit a partially plastered appearance. Particularly in the basement, attention is drawn to the carefully processed rubble stones obtained from the surrounding quarries. While Sille stone is the preferred main building material, the basement of the structure is constructed with rubble stone. These walls are supported by small rubble stones placed between wooden elements arranged in a triangular pattern on the first floor, and the wall surface is covered with adobe plaster.

Furthermore, the upper part of the ceiling, supported by round wooden beams on the first floor, is covered with Sille stone paving, creating a unique floor. This distinctive stone paving is partially used in the basement and ground floors as well, but it is most prominently featured in the main floor's inner living area (Table 2).

Wood Material

In terms of wood usage in the construction, tree species such as poplar, juniper, and willow were generally preferred. Additionally, pine and pitch pine were used to a limited extent. The ceilings of the structure present a design created with wooden round beams. Furthermore, it has been observed that wood material is used in elements such as doors, windows, especially window sills in the rooms, mirrors, flowerpots, wooden floor coverings, and the lintels of load-bearing walls (Table 2).

Brick Material

In the recent renovation works of the house located at 1-3 Nalpinar Street, it is observed that brick material has been used in the sub-counter walls. (Table 2)



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Adobe Material

Adobe, the traditional building material of Konya, is specially kneaded, molded, and then obtained by drying. The preferred adobe material in Sille houses is observed to be used not only in Konya but also extensively in many regions of Anatolia, especially in the Inner and Southeastern Anatolian regions, due to its effective insulation against hot and cold weather conditions, maintaining moisture balance in indoor spaces, fire resistance, widespread availability, low cost, and environmental friendliness (Bektaş, 1996). In these structures, adobe material is used as plaster in indoor spaces, and it is also observed to be partially used as plaster material on the external facade (Table 2).

Earthen Material

In traditional residential architecture, especially in the Central Anatolia Region, earth is used as the primary roofing material, and the traditional roof design is generally implemented as a flat earthen roof. Over the beams, materials such as reeds (kandıra, saz) or branches (ağaç dalı), grass, specially kneaded torak, and others are spread. Additionally, earth is used in some mixtures as a plastering material on the wall surfaces. Earthen material is also used in the interior spaces of the structure as room plasters and in exterior claddings. (Table 2)

Metal Material

Metal material is observed in window and door frames, as well as in railings. Metal material has been used in the railings of the windows on the ground and first floors, as well as in the recently renovated main entrance door and balcony railings of the structure. (Table 2)

Reinforced Concrete

Material During a recent restoration process, this material was incorporated, particularly in the section later added to the north of the structure, where reinforced concrete material was used as plaster on the floor and walls. (Table 2)

Structural Elements and Facade Typology

The structural elements of Hacı Ali Ağa Mansion include wooden doors and windows, wooden and reinforced concrete stairs regulating inter-floor transitions and level differences, wooden flooring, and round wooden beams. In the traditional Sille residence known as Hacı Ali Ağa Mansion, the windows are made of wood and rectangular-shaped windows and round-arched windows are prominent on the facade, either individually or in groups of three. Additionally, for energy efficiency and to make better use of sunlight, it is observed that windows are mostly placed on the southern facade. (Figure 20 and Figure 21)

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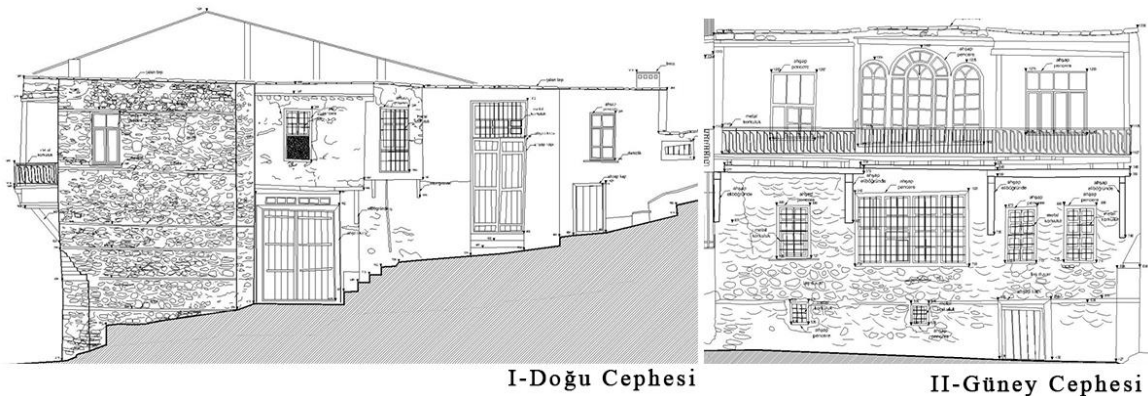


Figure 19. Eastern and western facade views of Hacı Ali Mansion (Sille Street Rehabilitation Survey Report, 2014)

In the past, the protrusion located on the southern facade has now gained the function of a balcony, and this balcony is supported by wooden brackets. The round-arched windows on the first floor feature colored glass, serving as an eye-catching decorative element. The doors in the outdoor and indoor spaces of the structure are made of wood, and it is observed that there are variations in their dimensions according to their respective areas. In this context, it is noted that the entrance doors are larger and more intricately crafted. (Figure 20 and Figure 21)



Figure 20. The Protrusion With Round-Arched Windows on the South Facade and the Eastern Facade of Hacı Ali Mansion (Sille Street Rehabilitation Survey Report, 2014)

6. CONCLUSION and RECOMMENDATIONS

As a result of the conducted research, it has been determined that the historical settlement of Sille, affiliated with the city of Konya, is remarkably rich and diverse within the scope of tangible and intangible heritage. The significance of this rural architectural heritage, formed by examining the traditional residential fabric, which constitutes the historical settlement and area of Sille, stands out prominently. In this study, the Hacı Ali Ağa Mansion, which exhibits the characteristics of a registered residence within the context of traditional Sille residential architecture, was evaluated by analyzing its plan and materials, reflecting its similarities with the Turkish House.

In conclusion, the historical settlement area of Sille and its traditional architecture, distinguished by its historical depth and cultural richness, not only sheds light on the past but also illuminates the present and the future. In this context, Sille city should preserve its status as an important tourist and cultural center, thanks to the rich atmosphere and historical fabric created by its traditional residential fabric.



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Therefore, the rich historical heritage of Sille should be passed down to future generations and should be considered as a resource for future researchers. It should not be forgotten that traditional residences are immovable cultural assets, and in the context of preservation and utilization of the vernacular architectural heritage they create, they should be preserved and handed down to subsequent generations.

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**RE-FUNCTIONING SUGGESTIONS FOR CONTAINERS USED AFTER
DISASTERS**

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ABSTRACT

Frequent earthquakes in recent years have brought many problems, especially shelter. Since it takes a long time to meet the need for permanent shelter after an earthquake, the temporary shelter of disaster victims should be met in a short time. In order to meet this need, containers, which are faster to produce, transport and install, are more preferred because their spatial comfort is higher than other sheltering alternatives. Containers with mobile and modular structure also allow different space organisations in terms of design flexibility. However, when the temporary sheltering functions of the containers used after disasters disappear, these building elements are sent to storage areas in an idle manner. In order to prevent the idle storage of these structures with high design flexibility, suggestions have been made within the scope of the study for the re-functionalisation of the containers used after the disaster, especially in the public space after the emergency. These suggestions have emerged as a result of the examination of the examples obtained in the literature research conducted within the scope of the study. This study is intended to guide the practices for the re-functionalisation of the containers that are out of use after the emergency shelter need disappears after the disaster.

Keywords: Disaster, Container, Public Spaces, Recycling.

1. INTRODUCTION

Since the existence of mankind, disasters, which are events that negatively affect societies or the environment and can lead to loss of life and material damages, have been occurring, although their dimensions vary. Disasters are events that disrupt the normal life order of societies and cause damage and destruction.

It is possible to see that natural disasters occurring in the country cause serious damage to the normal functioning and daily life of a society in line with the researches conducted. It affects daily lives and such disasters not only cause human loss, but also can lead to financial, economic and environmental damages. Looking at the current situation, it is seen that the ability of society to overcome these difficulties with its own resources is no longer possible (Canatan, H. (2020).

In Turkey, although there are necessary regulations to reduce earthquake damages, it is clearly seen that the negative effects of earthquakes cannot be prevented. Factors such as rapid population growth, internal and external migration, irregular urbanisation and industrialisation, illegal construction, slum construction, lack of education and inadequate supervision have increased the risk of natural disasters. This situation is clearly seen with the recent disasters that



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have occurred and finally, a great financial burden is imposed on the country. (UZUNÇIBUK, 2005).

Turkey is a country frequently exposed to natural disasters such as earthquakes, landslides and floods. (Seymen & Akın, 2014). Especially the Marmara Earthquake in 1999 caused great devastation for Turkey. In this earthquake, it is recorded that approximately 18 million people lost their lives, nearly 44 thousand people were injured and more than 20 million people were affected. In the 2011 earthquake in Van, 644 people lost their lives and more than 2,000 people were damaged by the earthquake. Our country also faces flood and landslide disasters every year and these disasters cause great loss of life and property (AFAD, 2014:20; İnal, Kaya & Altıntaş, 2018). Finally, it is stated in both local and international sources that the two separate earthquakes with a magnitude of 7.7 and 7.6, which occurred on 6 February, centred in Kahramanmaraş and were effective in 10 provinces, is one of the rare natural disasters. This disaster has turned into a great tragedy with more than 50 thousand casualties and more than 100 thousand injured according to official figures.

In Turkey, while recognising that natural disasters, especially earthquakes, are inevitable and it is becoming difficult to predict the magnitude, where and when an earthquake will occur, "Disaster and Risk Management" based on science and technology is gaining more and more importance in modern earthquake management. The perspective towards disaster management is changing worldwide and the concept and techniques of "Risk Management" are emphasised more than the traditional approach. In this context, disaster periods and normal periods are handled differently and techniques and managerial approaches specific to these periods are defined as "Disaster Management" and "Risk Management". In this perspective, the activities before, during and after the disaster are considered as different fields of expertise such as "Preparedness" - "Emergency Response (Rescue and First Aid)" and "Normalisation and Recovery of Society" - "Mitigation" activities (Uzunçibuk, 2005).

In disaster areas, people lose their homes and workplaces due to the shaking experienced. The needs of the people of the region who have lost their living spaces begin to arise in many areas. Containers can start to meet the needs of the people of the region in a short time because they are structurally very easy to transport and modular materials that can be shaped modularly. Containers, which can be both a health cabin and a dining hall, can easily return people's living spaces to normal life.

After a while, when the people living in the disaster areas return to their own homes and workplaces, the usage period of the disaster containers is over for that region. Containers have materials that are suitable for reuse in other areas and can also contribute to sustainable energy. They are rectangular and their surfaces are made of sheet metal.

The transport of containers is carried out by cranes and forklifts. With this technical feature structure, it can host a safe living space in every area.

Due to their durable structures and standard dimensions, they can be easily added side by side or on top of each other. It is preferred in modular structures due to its durability. Due to the ability of containers to be relocated, they can be used both as a structure in emergencies and as a structure in different designs.



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In this study, it is aimed to examine disaster containers within the scope of disaster management. It is aimed to pioneer innovative ideas by conducting researches in order to use them in the first aid moment and to make them sustainable in the future.

2. MATERIALS and METHODS

This study aims to be a different branch of a comprehensive research. At the same time, within the scope of this study, many suggestions are developed in order to prevent the containers from remaining idle after the first aid during the disaster. With this study, it is seen that the literature review is made and the existing applications related to this subject are seen within the scope of the study.

As a result of the literature review, it is seen that the containers used after many disasters are left idle in a certain part of the city after the recovery of the city and the transition to a settled order. In response to this situation, an improvement policy has been proposed. The design of new technological, energy-saving, different and social spaces will be examined and put into service in public spaces rather than the containers used in emergencies. In this way, it is planned to create social spaces that are both easy to recycle and sustainable. In the light of past studies, it is aimed to guide applications that are sustainable, open to new technologies and pay attention to energy saving.

3. FINDINGS and DISCUSSION

Turkey is constantly faced with earthquake risk due to its geographical location. More than half of the disasters in the last sixty years have been earthquakes. Many earthquake victim families have been confined to temporary housing solutions for long periods of time. Transition to permanent housing often requires a process that lasts for years. Factors such as the psychological effects experienced after the earthquake and the length of the transition to permanent housing, housing conditions and the design of temporary shelters are more important (Ünal & Akin, 2017).

While everything is progressing rapidly, the greatest need in disaster areas has emerged to create fast and reliable spaces. It has been determined that both green buildings and containers, which can be converted in a short time and easily transportable, are very accurate materials in terms of use (Yonar, 2009).

Containers are elements of high importance here. Accordingly, after the needs are met in the disaster areas, the design of the containers, which have expired, without leaving them idle in a corner, will provide savings in terms of economy and time and will serve people in public spaces.

From both an economic and durability point of view, a conventional building is under construction in order to create kindergartens, leisure areas, health cabins, kiosks in cities.

There is a significant difference between the cost of materials such as timber, bricks, mortar, etc. and the cost of a new container, and this difference is maintained in terms of durability. Not only the supply of materials, but also much more manpower and energy is needed in a traditional building. Since it requires manpower, cost of materials and licence during construction, it is inevitable to experience delays in delivery and completion time. On the other hand, work can be done to create a small house or office with one or two manpower in containers. In addition, licence etc. does not create a waste of time for permits. Another

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prominent feature is that containers can be combined with each other and brought together and arranged in different shapes and sizes. It is possible to design and put into use in accordance with each area (Madkour, 2017).

For example, it is seen that a container serving as a health cabin in the disaster area reduces the indoor temperature up to eight per cent when we equip the roof with plants by making use of nature. When we choose the material that can absorb heat in the windows, it is possible to heat the interior space by making use of the outside temperature very easily. Using solar energy in lighting, heating and cooling systems with solar panels to be installed on the roof or outdoor unit will contribute to sustainable energy saving. When this container, which is insulated and whose windows are designed according to the climate, ends its service in the disaster area, it can be moved to another region without requiring any additional change and can be used not as a health cabin but as a venue hosting performing arts.

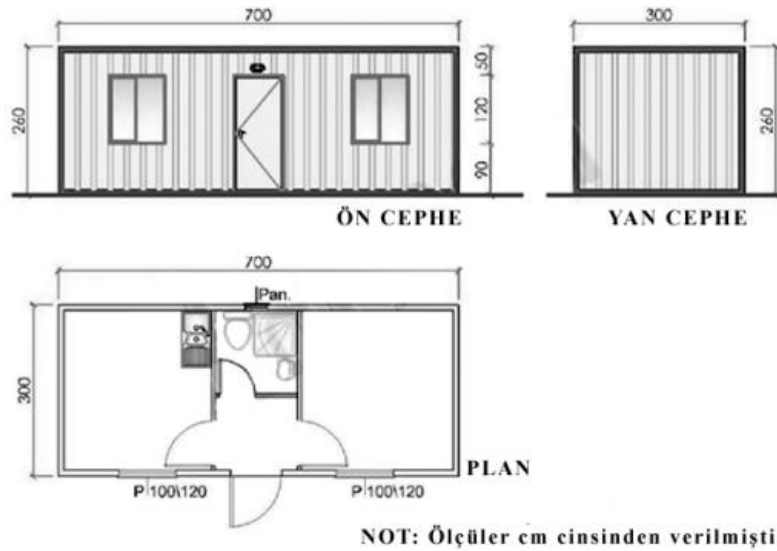


Figure 1. Temporary disaster housing plan and facades (Ünal & Akın, 2017)

The containers used to meet the need for temporary shelter consist of 21 m² seating area and contain 2 rooms, kitchen, bathroom and toilet (Picture 1) (Ünal & Akın, 2017).

It is seen that there is a 120 cm long kitchen counter/cabinet with a recessed steel sink in one room in order to meet the kitchen needs in disaster houses. Apart from the counter, there is no furnishing for the kitchen space (Picture 2, 3) (Ünal & Akın, 2017). It is seen that there is a 120 cm long kitchen counter/cabinet with a recessed steel sink in one room in order to meet the

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kitchen needs in disaster houses. Apart from the counter, there is no furnishing for the kitchen space (Picture 2, 3) (Ünal& Akın, 2017).



Figure 2. Kitchen (Ünal& Akın, 2017) **Figure 3:** Kitchen (Ünal & Akın, 2017)

This bathroom is 1.5 metres wide and 1.5 metres long, with a total area of 2.25 square metres. The bathroom is equipped with a washbasin, shower cubicle, electric water heater (thermosiphon), an alafraंगा toilet and a ventilation window. However, there is no storage space in the bathroom. This space has the ability to receive natural light and a luminaire on the ceiling is used for night lighting (Ünal& Akın, 2017).

According to the available information, the two rooms, which are 2.8 metres wide and 2.6 metres long, cover a total area of 7.28 square metres. These rooms do not contain any furniture or items for sitting or resting. Victims of earthquakes or other disasters use the belongings they survived or were able to obtain. The walls and ceiling of both rooms are painted in white colour. Each room receives natural sunlight through windows on one side of the room, while overhead lighting is used at night. There is no storage space in this container dwelling (Ünal& Akın, 2017).

As a result of these, the project examined the design of new technological, energy-saving, different and social spaces and opening them to service in public spaces instead of leaving the containers idle after their use for emergency shelter and needs in both green building and disaster areas (Beyatlı, 2010).

The example in Figure 4 below is one of the best examples of how disaster containers can be combined, divided and resized. We can talk about their transformation into youth centres to be designed in similar ways and used in public spaces. Since it is deformed while being used only as a disaster shelter, after a few repairs, modifications and designs, it can be adapted to every area and put into service quickly.



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Figure 4. Transformation of disaster containers into youth centre (Keskin, 2015).

The image below shows some containers that were used as disaster dwellings and were not left idle afterwards. With renovations and most importantly designs, social areas have been created in public spaces. There is an art centre where various artists can exhibit their works. The roof of the art centre has also been greened and put into service as social areas that can appeal to everyone from young to old.



Figure 5. Transformation of disaster containers into art centre and social space
(www.prefabcontainerhomes.org)



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Figure 6. Transformation of disaster containers into free service areas

In the picture below, it was used as a health cabin in the disaster area, and then it was transformed into free toilets, masjids, baby care rooms that can be used by many people in public spaces by installing installations inside.

4. CONCLUSION and RECOMMENDATIONS

The use of containers as an alternative to the need for emergency shelter after a disaster and the possibility of recycling the material makes them a rational choice for contemporary designers and users. It would be more economical than building a new traditional building to transform the containers, which can actually be reused after a little organisation and repair, into quality living spaces instead of waiting for them to rot in a corner in an idle state.

In disaster areas, containers are left aside for reasons such as expiry or wear and tear. Recycling of containers is important in terms of sustainable architecture. These transformations stand out as a rational choice for contemporary designers and users. Structural deficiencies, insulation, acoustics, natural lighting issues of containers can be eliminated with very simple architectural solutions. It would be more economical than building a new traditional building to transform the containers, which can actually be reused after a little organisation and repair, into quality living spaces instead of waiting for them to rot in a corner in an idle state.

The designed new spaces can be combined with each other like giant logo pieces and transformed into large social areas. It is known that such projects with traditional structures will be high in time, energy and economic terms. However, it can be transformed into social spaces in public spaces that can be easily transported from disaster areas to city centres where needs are met. Thus, it is expected that it will attract people's attention more and inspire sustainable energy.

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EVALUATION OF THE RELATIONSHIP OF SOCIAL VULNERABILITY TO EXCESSIVE RAINFALL WITH SPATIAL VULNERABILITY BASED ON LOCATION SELECTION CHARACTERISTICS: THE CASE OF İZMİR

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ABSTRACT

With the increase in excessive rainfall due to climate change, cities and their citizens are exposed to floods. In this exposure, many factors play an important role in determining the vulnerability of city population. At this point, social, economic and demographic characteristics of the population are effective in determining the level of vulnerability to disasters. Socially vulnerable groups have inadequacies in terms of compensating the damages when exposed to disasters. On the other hand, the development patterns of cities are also very effective in terms of exposure to floods due to excessive rainfall. Although it is stated in the literature that socially disadvantaged groups live in disaster-prone areas, it can be argued as a hypothesis that such a generalization can't always be made due to the advantages offered by various regions within the city such as scenery and proximity to the center. In order to test this hypothesis, the study aims to determine the vulnerability levels of the spatial location choices of socially vulnerable groups. For this purpose, social and spatial vulnerability levels were determined at the neighborhood scale in Izmir, which was selected as the study area, and the levels obtained were examined comparatively. As a result, it was found that 35% of the socially vulnerable population is located in spatially disadvantaged areas. Therefore, it is seen that socially vulnerable groups don't always choose to live in spatially disadvantaged areas.

Keywords: Climate Change, Excessive Rainfall, Social Vulnerability, Spatial Vulnerability.

1. INTRODUCTION

Climate change is one of the most important problems of our time, affecting all systems of nature and posing a serious threat to human life. Climate change has many impacts that increase in intensity over time and damage ecological and social systems. Excessive rainfall is one of the most important impacts of climate change. According to IPCC (2021), since the 1950s, there has been an increase in the frequency, intensity and severity of extreme rainfall in terrestrial areas due to climate change. The increase in the intensity and duration of precipitation leads to flooding disaster events in cities. Flood disasters caused by excessive and sudden rainfall adversely affect cities and the population living in cities. Flooding in cities causes many vital, physical, social and economic problems such as property damage, destruction of livelihoods, destruction of urban infrastructure systems, disruption of transportation, mixing of clean water and sewage water, spread of water-borne infectious diseases, injury and death.



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Cities, where population, structural assets and economic activities are concentrated, are highly vulnerable to the impacts of climate change. Today, cities and their inhabitants are frequently exposed to disaster events caused by excessive rainfall. Many factors play an important role in determining the vulnerability of urban population when exposed to disasters caused by excessive rainfall. At this point, social, economic and demographic characteristics of the population are very effective in determining the level of being negatively affected by flood disasters. In terms of social characteristics; children, the elderly, women, the disabled and the poor are the disadvantaged groups that are most affected by disaster events that develop with excessive rainfall (Cutter, Emrich, Webb, & Morath, 2009; Baker, 2012). Socially vulnerable groups are most likely to be harmed and affected by disasters associated with excessive rainfall (Rufat, Tate, Burton, & Maroof, 2015). When exposed to disasters, these groups have inadequacies in terms of compensating for the damages incurred and consequently have a low capacity to recover from damages. In this context, it is frequently stated that the urban poor are the most vulnerable groups (Gökçe, 2017).

On the other hand, the spatial development patterns of the city in the context of location selection are also very effective in terms of exposure to disasters that may occur in case of excessive rainfall. Location characteristics such as the height of the city from the sea, its topographic structure, coastal length, and settlement status in stream floodplains play an important role in determining the level of spatial vulnerability to excessive rainfall. People living in stream floodplains, seashores and low-slope areas face flood disasters more frequently.

In general, it is stated in the literature that socially disadvantaged groups live in disaster-prone areas such as river floodplains and coastal areas (Dodman & Satterthwaite, 2008; Dangol & Carrasco, 2019). However, it can be hypothesized that the opportunities offered by various regions within the city, such as views and proximity to the center, cause socially advantaged groups to choose locations in disaster-prone areas, and therefore such a generalization can't always be made. In order to test such a hypothesis, this study evaluates the location choices of vulnerable groups based on their social characteristics in vulnerable regions in terms of their spatial characteristics. In order to make this assessment, indicator-based vulnerability analysis was conducted at the neighborhood scale in Izmir, which was selected as a sample area, and social and spatial vulnerability levels were determined and the obtained levels were examined comparatively.

2. MATERIALS and METHODS

Case Area

The 11 central districts of Izmir province constitute the study area (Figure 1a). In the neighborhood scale study, a total of 388 neighborhoods, including Balçova (8 neighborhoods), Bayraklı (24 neighborhoods), Bornova (45 neighborhoods), Buca (47 neighborhoods), Çiğli (27 neighborhoods), Gaziemir (16 neighborhoods), Güzelbahçe (12 neighborhoods), Karabağlar (58 neighborhoods), Karşıyaka (27 neighborhoods), Konak (113 neighborhoods) and Narlıdere (11 neighborhoods) were included (Figure 1b).

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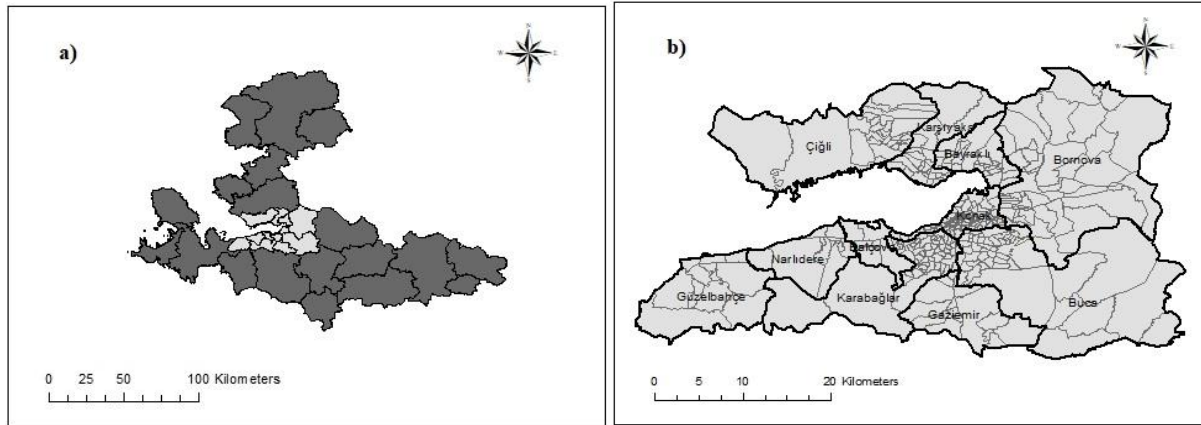


Figure 5. a) Borders of Izmir province, b) Area boundaries of Izmir central districts (Source: It was created by the authors within the scope of the study.)

Explanation of the Indicators

Social and spatial indicators were utilized to determine the levels of social and spatial vulnerability to excessive rainfall (Table 1). Each social and spatial indicator identified to identify vulnerabilities is explained below, along with the reasons for their selection in accordance with the purpose of the study.

Table 3. Indicators used in vulnerability analysis

Name Of Indicator	Indicator Factor	Abbr.	Unit	Definition	Data Sources	Type Of Indicator
Female Population	Social	SO _F	person	Number of women and girls	TUIK	Sensitivity
Child Population	Social	SO _C	person	Number of children (0-14)	TUIK	Sensitivity
Elderly Population	Social	SO _E	person	Number of people aged 65 and older	TUIK	Sensitivity
Disabled Population	Social	SO _D	person	Number of people with disabilities	TUIK	Sensitivity
Education Status	Social	SO _{ES}	%	Literacy rate of neighborhoods (15 years and older)	TUIK	Adaptive Capacity
Access to Health	Social	SO _{AH}	m	Proximity to the nearest hospital from the very center of the neighborhood	Measured by the authors using Google Earth Pro	Resilience
Socioeconomic Development Level	Social	SO _{SD}	person	Socio-economic development ranking of districts	Republic of Turkey Ministry of Industry and Technology	Adaptive Capacity
Slope	Spatial	SP _S	%	Average slope of the neighborhood	Measured by the authors from SRTM digital elevation map	Resilience



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Elevation	Spatial	SP _E	m	Average elevation of the neighborhood relative to sea level	Measured by the authors from SRTM digital elevation map	Resilience
Rate of Construction in Stream Floodplain	Spatial	SP _{RC}	%	Rate of construction in the stream floodplain to the size of the neighborhood	Measured by the authors using Open Street Map (OSM)	Exposure

Social Indicators

Floods caused by excessive rainfall make urban population vulnerable, causing many injuries, deaths and damage to property and assets. At this point, social, economic and demographic characteristics of the urban population are very important in determining the vulnerability of population exposed to disasters. Age, gender in terms of demographics; income, poverty, education level and health in terms of socioeconomics are among the main factors affecting social vulnerability (Rufat, Tate, Burton, & Maroof, 2015; Kirby, et al., 2019). In this context, women, children, the elderly, the disabled, and the poor stand out as vulnerable groups most affected by disaster events (Cutter, Emrich, Webb, & Morath, 2009; Baker, 2012; Rufat, Tate, Burton, & Maroof, 2015). These vulnerable groups create evacuation difficulties during disasters due to their household dependency and limited mobility. Therefore, socially vulnerable groups have a high likelihood of being harmed and affected by disaster risks due to excessive rainfall and a very low capacity to cope with the economic damage costs caused by disasters.

The level of socioeconomic development is also important in terms of the potential to cope and adapt to disaster risks. In societies with more economic assets and material resources, the capacity to cope with floods is higher and vulnerabilities are lower (Herslund, et al., 2016). In other words, the capacity of poor households to cope with damage costs from flood disasters is much lower compared to rich households (Rufat, Tate, Burton, & Maroof, 2015). Factors such as education level, literacy rate and health also affect social vulnerability (Rasch, 2016; Rufat, Tate, Burton, & Maroof, 2015). The high level of education of societies increases the level of consciousness and awareness against disaster risk. Societies with previous disaster experience are considered to be less vulnerable as they are more cautious against disasters (Herslund, et al., 2016). Access to health is very important in terms of the capacity to cope with health problems that may occur during and after a disaster. For these reasons, child, elderly, women and disabled population, socioeconomic development level, education level and health access were used as social indicators in the study (Table 1).

Spatial Indicators

Environmental risks and climate-related disasters have inequalities in their geographical spatial distribution (Chuang, Chen, & Lin, 2020). For this reason, the extent to which different urban regions are negatively affected by climate change-related disasters varies according to the geographical characteristics of the area where they are located (Aydın & Kahraman, 2022). Therefore, in case of exposure to disasters caused by excessive rainfall, spatial development patterns in the context of the city's location characteristics are important. For this reason, factors such as the city's elevation above sea level, slope and settlement status in stream floodplains are considered as indicators of spatial vulnerability. As the altitude of a city decreases, its



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susceptibility to flood disasters increases. Low slope is also identified as an indicator that increases spatial vulnerability. Floods are more common in flat areas with low slopes. Another spatial indicator is the rate of construction in stream floodplains. As a result of the opening of naturally flowing stream beds to construction, the inability to drain excessive amounts of rainwater during precipitation leads to flood disasters in cities. Thus, the rate of construction in stream floodplains is considered as an indicator that increases vulnerability.

METHOD

In the literature, there are various vulnerability calculation formulas that are defined as a function of vulnerability, taking into account components such as impact, exposure, sensitivity, resilience and adaptive capacity. The basic approach in vulnerability calculations is that impact severity, exposure and sensitivity have a positive effect on vulnerability, while resilience and adaptive capacity have a negative effect on vulnerability (see Luers, 2005; Gbetibouo & Ringler, 2009; Balica, Wright, & Meulen, 2012; Aydın & Kahraman, 2016). Therefore, as impact, exposure and sensitivity increase, vulnerability increases; as resilience and adaptive capacity increase, vulnerability decreases. Accordingly, in this study: Vulnerability = (Exposure x Sensitivity) / (Resilience x Adaptive Capacity), social and spatial vulnerability levels were calculated.

$$\text{Social Vulnerability Formula} = \frac{SO_F \times SO_C \times SO_E \times SO_D}{SO_{ES} \times SO_{AH} \times SO_{SD}}$$

$$\text{Spatial Vulnerability Formula} = \frac{SP_{RC}}{SP_S \times SP_E}$$

Before applying the social and spatial vulnerability formulas, the values were normalized so that indicators obtained from different types could be examined together. After normalizing the indicator data, social and spatial vulnerability calculations were made. The results of the calculations were spatialized using the ArcGIS program. The results were categorized in 5 levels as very high (level 1), high (level 2), medium (level 3), low (level 4), very low (level 5) using the Geometric Range Classification Method in Geographic Information Systems (GIS). Thus, maps of social and spatial vulnerability levels were produced.

3. FINDINGS

As a result of the calculations based on the indicators, maps of social and spatial vulnerability levels were created. These vulnerability maps contribute to the examination of the relationship between social and spatial vulnerability levels. When the vulnerability levels in terms of social characteristics against excessive rainfall are examined, it is seen that 12% of the neighborhoods are in the very high (level 1), 21% in the high (level 2), 23% in the medium (level 3), 19% in the low (level 4) and 25% in the very low (level 5) vulnerability category. Accordingly, 33% of the neighborhoods have very high and high vulnerability levels, while 67% have very low, low and moderate vulnerability levels.

The most socially vulnerable areas were determined to be parts of coastal areas (Bayraklı, Karşıyaka, southwest of Konak) and city centers (Buca, Bornova, Gaziemir, Karabağlar). The results show that, in general, vulnerability decreases from the urban built-up area to the periphery. Therefore, the peripheries of the city have the lowest social vulnerability as the least populated areas (Figure 2).

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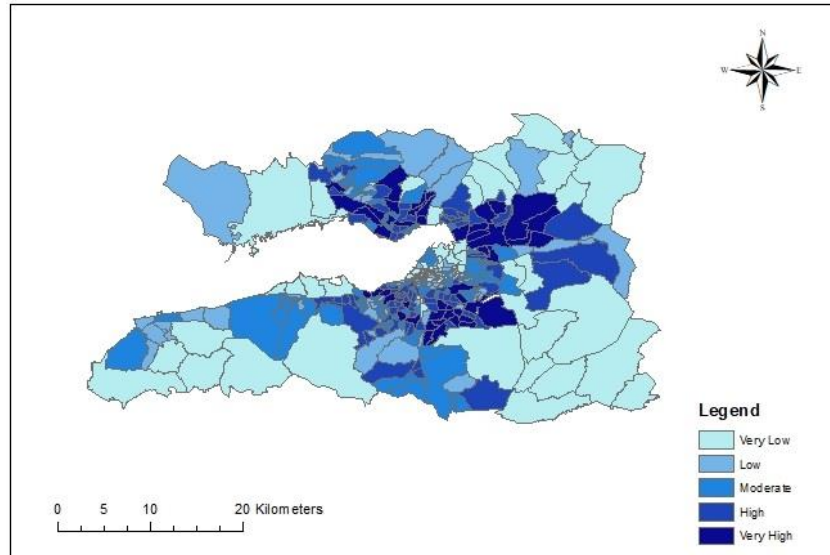


Figure 6. Social vulnerability levels of neighborhoods to excessive rainfall

When the spatial vulnerability levels based on location characteristics against excessive rainfall are examined, it is seen that 15% of the neighborhoods have very high (level 1), 15% have high (level 2), 4% have moderate (level 3), 7% have low (level 4) and 59% have very low (level 5) vulnerability levels. Therefore, 30% of the study area has very high and high spatial vulnerability levels, while 70% has very low, low and moderate spatial vulnerability levels.

In terms of spatial characteristics, some of the coastal areas (Çiğli, Karşıyaka, Bayraklı, Balçova, Narlidere, Güzelbahçe) and stream flooding areas within the built-up area (Bornova, Buca, Karabağlar, Gaziemir) were identified as areas with very high and high vulnerability (Figure 3).

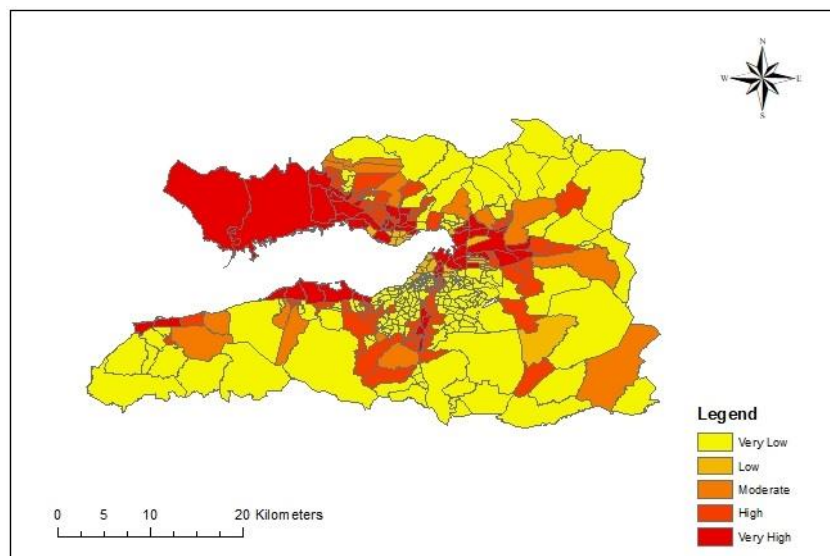


Figure 7. Spatial vulnerability levels of neighborhoods to excessive rainfall



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In line with the purpose of the study, a matrix table was created to understand the relationship between social vulnerability to excessive rainfall and spatial vulnerability based on location characteristics and to make a comparative analysis (Table 3). Table 3 below presents the distribution rates of social vulnerability levels in terms of spatial vulnerability levels.

Table 4. Distribution of social vulnerability levels in terms of spatial vulnerability levels

		Levels of Spatial Vulnerability				
		Level 1 (%15)	Level 2 (%15)	Level 3 (%4)	Level 4 (%7)	Level 5 (%59)
Level of Social Vulnerability	Level 1(%12)	%28.3	%19.5	%6.5	%2.2	%43.5
	Level 2(%21)	%12.2	%15.8	%3.6	%7.3	%61
	Level 3 (%23)	%10	%15.5	%3.3	%12.2	%59
	Level 4(%19)	%13.5	%20.3	%4	%4	%58.2
	Level 5(%25)	%16.7	%9.4	%2.1	%8.3	%63.5

When the distribution of vulnerability levels is analyzed, it is interesting to note that 43.5% of the population with the highest social vulnerability (Level 1, 12%) live in the most spatially advantageous regions. On the other hand, 35% of the population exhibiting very high and high social vulnerability (Level 1 and 2), 35% of the population exhibiting very high and high social vulnerability (Level 1 and 2), 5% of the population exhibiting moderate social vulnerability (Level 3), and 60% of the population exhibiting low and very low social vulnerability (Level 4 and 5). Therefore, 35% of the socially vulnerable groups were found to be located in areas with vulnerable spatial characteristics such as coastal areas (Bayraklı, Karşıyaka), areas just behind the coast (Çiğli, Bayraklı, Karşıyaka) and stream flood areas (Buca, Bornova and Karabağlar city centers). It is seen that 60% of the socially vulnerable groups chose to live in areas with very low and low spatial vulnerability such as the coastal edge (southwest of Konak) and urban centers (Gaziemir, Karabağlar, Buca, Bornova).

Among the population with very low and low social vulnerability, 29.5% live in areas with very high and high, 3% in areas with moderate and 67.5% in areas with low and very low spatial vulnerability. Thus, 29.5% of the socially less vulnerable groups were found to be located in coastal areas (Güzelbahçe, Narlıdere, Balçova, Çiğli and northeast of Konak) with very high and high spatial vulnerability. Another 67.5% of the less vulnerable groups based on social characteristics were located in areas with very low and low spatial vulnerability. These areas are mostly located on the peripheries of the city.

4. CONCLUSION

In this study, firstly, social and spatial vulnerability levels to excessive rainfall are determined. A comparative analysis of the identified social and spatial vulnerability levels based on location characteristics is presented. The findings revealed that the social and spatial vulnerability levels of neighborhoods may show regional similarities and/or differences. In other words, there is



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no consistency between the vulnerability of the population living in the neighborhoods based on their social characteristics and the spatial vulnerability to excessive rainfall due to the physical location of the neighborhood. Therefore, it is observed that socially vulnerable groups are not always located in areas that are vulnerable in terms of their spatial characteristics. Although it is known that the socioeconomic and demographic characteristics of the population are very important in terms of the capacity to cope with disasters, the results of this study conducted in the case of the city of Izmir also form the basis for a discussion that the location characteristics of the living spaces of urban population may be of primary importance in combating disasters caused by climate change. Therefore, it is clear that making disaster resilience spatial location decisions in urban planning processes is important within the framework of adaptation policies.

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**RAINFALL RECYCLING: INNOVATIVE APPROACHES FOR SUSTAINABLE
WATER MANAGEMENT IN URBAN AREAS**

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ABSTRACT

Today, factors such as climate change and urbanization are complicating the management of water resources and leading to increased water scarcity in urban areas. In cities, rainwater is typically collected through drainage systems and subjected to treatment processes. However, the effectiveness of these processes remains limited and systems can overflow during periods of rainfall. At this juncture, rainwater recycling in urban areas carries great importance in terms of water resource conservation and sustainability. The integration of green infrastructure systems and modern technologies provides environmental and economic benefits while optimizing water management. Green infrastructure systems enable the natural management and infiltration of rainwater. For instance, rain gardens and bioswales capture, purify and naturally permeate rainwater into the soil. Designed soils contribute to rainwater recycling, enhancing the natural infiltration process of water. Furthermore, recycled rainwater can be used for irrigation purposes, contributing to the preservation of freshwater resources. With current technology, tools like unmanned aerial vehicles and smart water measurement can be used to monitor and evaluate the performance of rainwater management systems. This paper examines the potential of green infrastructure technologies for capturing, recycling, and reusing rainwater. It proposes how rainwater recycling can be utilized as an innovative and effective method for sustainable water management in urban areas. These approaches contribute to the preservation of water resources and increase resilience against the adverse effects of climate change. They also aid in enhancing the quality of life for communities, protecting the ecosystem, and managing water resources sustainably.

Keywords: Rainwater, Sustainability, Urbanization, Infrastructure, Resilience.

1. INTRODUCTION

The rapid population growth in urban areas worldwide and the effects of climate change have made water scarcity one of the most pressing issues of today. This situation necessitates the creation of sustainable water management strategies for cities. Rainwater recycling is at the forefront of these strategies, with many successful examples implemented in various cities drawing attention.

Today, factors such as climate change and urbanization are complicating the management of water resources, leading to increased water scarcity in urban areas. In urban regions, rainwater



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is typically collected through drainage systems and subjected to treatment processes. However, the efficiency of these processes can be limited, and during heavy rainfall, systems can become overwhelmed. At this point, rainwater recycling in urban areas becomes of great importance for the conservation of water resources and sustainability. The integration of green infrastructure systems and modern technologies provides environmental and economic benefits while optimizing water management.

Grey and green infrastructure technologies can play a significant role in managing rainwater and preventing potential flooding events. Grey infrastructure captures, treats, and discharges rainwater using concrete and steel pipes, pools, and other structural components (Rueter, 2014).

Green infrastructure systems offer natural means of managing and infiltrating rainwater. For instance, rain gardens and bioswales capture rainwater, treat it, and allow it to naturally infiltrate the soil (Harnik & Martin, 2016).

2. Approaches for Capturing, Recycling, and Reusing Rainwater

With climate change, the frequency and intensity of storms are increasing. Additionally, due to land development, the amount of impervious surfaces and pollutants are also on the rise. This emphasizes the importance of rainwater management. Capturing, recycling, and reusing rainwater have become a crucial necessity for urban water sustainability. These approaches include:

a. Engineered soils – Processed lands

Soils developed with engineering applications are created by combining various organic and inorganic components (sand, clay, mulch, etc.). The mixing of these components in specific ratios, and in some cases using iron-coated sand or nanoparticles-treated soils, can significantly enhance the soil's water absorption and pollutant removal abilities. These characteristics allow the soil to slow down natural rainwater flow and capture pollutants, sediments, and oils present in the rainwater.

Global practices demonstrate the efficacy of processed soils and nanoparticles. For example, at Wooster College's campus in Ohio, Osorb, a silica-based nanoparticle capable of absorbing oil and other pollutants in water, has been utilized (O'Brien & Walton, 2012). This implementation significantly improved water quality, and plants were observed to thrive in this soil mixture.

Effectively holding rainwater in the soil plays a critical role in water management. Processed soils can reduce water evaporation and promote groundwater infiltration. Studies on the water retention capacities of different soil components, like sand, clay, and organic matter, show how engineering applications can optimize these capacities. Particularly in urban areas, soil engineering practices are becoming increasingly vital for effective rainwater management (Fecht, 2013).

b. Underground storage basins

According to the United States Environmental Protection Office, Municipal Technology Branch, (2001), underground storage basins are structures designed to store rainwater below ground. Not only can they reduce flood risks in cities, but they can also enhance water's reusability. Especially during heavy rainfall periods, these basins control rainwater and prevent overexploitation of surface water resources. Underground basins are a prevalent grey infrastructure solution for rainwater management and can be especially beneficial in urban



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settings. When combined with rainwater capture or irrigation technologies, underground basins can help manage floods while reducing water bills.

For instance, the development of Wescott Park in Northbrook City, Illinois, can be highlighted. Under the Main Stormwater Management Plan, the city has implemented various infrastructure projects to mitigate flooding risks. Among these projects is the enhancement of a storm sewer connected to a 7.5 million-gallon storage chamber located beneath the park's play areas. Additionally, the park management set up an electronic rainwater collection system, allowing the stored water to be used in a new grass irrigation system and pumped into truck-mounted tanks for watering trees and cleaning streets and sewers. Such an implementation reduces water usage, cuts down on irrigation costs, and decreases the risk of flooding in the vicinity (Wescott Park Stormwater Storage Facility, 2016).

c. Drones

Drone technology holds significant potential in optimizing rainwater collection and distribution methods. Monitoring through drones can pinpoint the most appropriate rainwater collection sites, allowing for more effective water management strategies.

Drones can assist in monitoring green and grey infrastructures, sampling the quantity and quality of water, and facilitating efficient rainwater management (Macalla, 2015).

Drones can access challenging areas and can be used to produce consistent datasets (WEF Stormwater Institute, 2015). Moreover, in urban settings, they can be vehicles for capturing public interest and fostering citizen awareness.

d. Real-time control and continuous monitoring and adaptive control

Real-Time Control is a technological approach that enables stormwater management infrastructure to quickly adapt to changing environmental conditions. The efficiency of stormwater recycling can be enhanced through continuous monitoring and real-time control. Adaptive control systems optimize stormwater management based on changing weather conditions and water needs. This technological approach plays a critical role in preserving water resources.

Real-Time Control improves the existing stormwater infrastructure using sensors and software (Kerkez et al., 2016). These systems rely on weather forecasts to effectively utilize capacity, capture water, and remove pollutants. They control the function of the infrastructure based on real-time data. However, technical challenges require oversight by personnel, and weather forecasts may not always be accurate.

In real-world applications, in Lenexa, Kansas, an example can be found where existing stormwater ponds have been enhanced with CMAC technology in collaboration with OPTi Technologies.

This technology has been used to adjust the input and output parameters of the pond based on weather forecasts. For instance, when the expected rainfall amount increased, the pond levels were lowered. Also, when there was a 70% or higher chance of rain, the valves were adjusted to drain the water. This application demonstrates how Real-Time Control and CMAC technologies can optimize stormwater management. However, in practice, additional infrastructure measures had to be taken to prevent debris from clogging the system (Jacobs, 2017).



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e. Rainwater harvesting

Rainwater harvesting is a method of collecting, storing, and directing rainfall for various purposes. This technique is often used for applications such as landscaping, livestock, fire prevention, and slow water release to the soil. Rainwater harvesting systems can vary in size and complexity; however, they typically consist of a water catchment surface, a conveyance system, storage, distribution, and treatment components. In most cases, the collection surface is a roof equipped with gutters and pipes that direct the rainwater into a cistern. This technique assists in effectively managing rainwater, reducing surface runoff and flooding, and lowering overall water costs.

Rainwater collected from roofs, gardens, and other surfaces can greatly contribute to water savings. Especially in arid regions, rainwater harvesting plays a crucial role in effectively managing water resources.

Real-world examples provide tangible demonstrations of how this technology can be applied. For instance, the Cloud House project in Springfield, Missouri uses rainwater harvesting to illustrate the connection between the water cycle and food production (Stormwater Report, 2017).

The Rotterdam Basin, created by Rotterdam-based designers DoepelStrijkers, demonstrates how cities can adapt to climate change and increasing rainfall. This structure is made from recycled plastic rainwater pipes and collects and drips rainwater into a pond. Both projects showcase how rainwater harvesting can be designed as interactive public exhibits to raise awareness about water and environmental issues (Cooke, 2016).

f. Greywater recycling

Greywater recycling allows for more efficient use of water resources for toilet flushing, garden irrigation, and other purposes. In many cases, greywater recycling can replace the use of potable surface and groundwater sources for irrigation, enhance the value of the water used, and improve plant growth by providing small amounts of nitrogen and phosphorus. Water conditions should be frequently tested using remote sensors and manual observations to address concerns related to human health and the environment.

g. Permeable paving

Permeable paving can replace traditional concrete and asphalt to allow water to seep into the ground, reducing the load on the stormwater drainage system, cooling the area, and preventing floods. While the material is weaker than concrete and requires more maintenance, it can be used in many areas and can manage stormwater effectively, reducing long-term maintenance costs.

In 2011 in California, permeable pavements were placed in certain sections of the parking lots in Oak Park, located in Santa Barbara. While the permeable pavement is not situated in driving corridors due to heavy traffic, it is present over parking spots. Even with only specific portions of the parking lot being permeable, it significantly increased the overall permeability of the site, reduced water runoff, and increased water infiltration into the site.

This example shows that when applied correctly, permeable paving can offer significant ecological and operational benefits.



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h. Green roofs

Adding vegetation to building roofs collects rainwater and provides insulation. Green roofs not only enhance the energy efficiency of buildings but also contribute to urban water management. Green roofs assist with low-impact stormwater management and also cool the underlying structure. They conserve water and energy, potentially improving public health and well-being, but require buildings with appropriate load-bearing capacity and space. They also demand more maintenance than traditional roofs.

In 2001, a semi-intensive green roof project was implemented at the Chicago City Hall as part of the Urban Heat Island Initiative in response to a deadly heatwave in the city. The project yielded positive impacts in terms of biodiversity, energy savings, and stormwater management. Compared to surrounding roofs, it retained 75% of the rainwater that fell on it, reduced the building's energy consumption costs by over \$5,000 annually, and decreased noise pollution by up to 40 decibels (Buchanan, 2015).

i. Smart water metering

The integration of sensor technology into water management enables effective monitoring of water usage and rainwater recycling. This aids individuals and communities in becoming more conscious about water conservation. Smart water metering can be considered a vital tool for sustainable use of water resources and enhanced energy efficiency.

Smart water metering services are usually implemented in two ways. Firstly, Automatic Meter Reading (AMR) service, a more cost-effective option, gathers water usage data and provides this information to the service provider, offering a basic service. On the other hand, the Advanced Metering Infrastructure (AMI) service, a higher-cost option, employs in-ground sensors and two-way digital communication. Smart water meters simplify data collection, can be used to detect leaks, and facilitate communication among maintenance personnel. The collected data can be analyzed to inform users and public services about water usage trends and to invest in new technologies. Furthermore, smart meters can be combined with greywater recycling systems to determine how greywater can effectively contribute to irrigation.

3. CONCLUSION

Urban areas are increasingly facing water crises due to various factors, including climate change, population growth, and insufficient infrastructure. In this context, expanding rainwater recycling practices plays a crucial role in sustainable water management. The integration of technology and green infrastructure encourages the conservation and sustainable use of water resources. Adopting such innovative approaches for water management in urban areas will reduce future water scarcity risks. Especially considering the challenges posed by climate change and urbanization, the adoption of these approaches is necessary.

Sustainable water management in urban areas is becoming an increasing necessity. Rainwater recycling is used to address this need through various methods and technologies. Some of these methods utilize traditional grey infrastructure systems, while others employ green infrastructure systems. However, both approaches have their advantages and limitations. For optimal results, the integration and adaptation of both approaches are required according to unique geographical and climatic conditions. Broad-scale applicability of such approaches requires collaboration among relevant municipalities, NGOs, the private sector, and local communities. In regions at



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risk of water scarcity, rainwater recycling and sustainable water management could be the key to economic and environmental sustainability.

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**DIGITAL TRANSFORMATION IN URBAN LANDSCAPE AREAS: THE
INTEGRATION OF TECHNOLOGICAL INNOVATIONS AND THEIR
CONTRIBUTIONS TO USER INTERACTION**

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ABSTRACT

Effective management and user interaction of urban landscape areas have critical importance amidst the rising urban population and changing social needs. This study investigates the integration of digital technologies in urban landscape areas, examining their operation, access, security, and user interactions. Specifically, it focuses on the advantages and disadvantages that Wi-Fi, Geographic Information Systems (GIS), mobile applications, and Internet of Things (IoT) technologies offer in the management and user interactions of urban landscape areas. The spread of mobile technologies and the increased Wi-Fi accessibility encourage user participation and interaction in public spaces, enhancing the appeal of cities. It has been shown that mobile device users have a higher level of interaction in public areas compared to non-digital users. Digital communication strengthens social ties among users in urban landscape areas and facilitates information sharing. Sharing user experiences via photos and videos boosts the promotion and usage of these areas. The Internet of Things (IoT) increases efficiency in managing urban landscape areas by providing remote data collection, storage, and sharing capabilities. These technologies foster safer and more accessible environments for users while supporting the sustainable management of natural resources. This study systematically evaluates how the integration of digital technologies can optimize the management of urban landscape areas and enhance user interactions. Additionally, it provides strategic approaches and recommendations for effectively integrating these technologies.

Keywords: Landscapes, Digitization, Interaction, IoT, Sustainability.

1. INTRODUCTION

The management and user interaction of urban landscape areas have gained critical importance in the context of increasing urban population and changing social needs. This study examines the integration of digital technologies in urban landscape areas, focusing on operations, accessibility, security, and user interactions.

Specifically, the advantages and disadvantages presented by technologies such as Wi-Fi, Geographic Information Systems (GIS), mobile applications, and the Internet of Things (IoT) in the management and user interactions of urban landscape areas are highlighted.



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Digital Transformation in the Development of Urban Landscape Areas

The evolution of digital technologies has a significant impact in the urban landscape domain, affecting how cities are planned, designed, and managed. Digital communication in urban landscape areas strengthens social bonds among users and facilitates information sharing. Sharing experiences through photos and videos enhances the promotion and use of landscape areas.

Digital tools have had a significant effect on community building in urban landscape areas. They make it easier for people to share information and resources and organize events and activities that bring people together.

Smart city technology also plays a role in ensuring user safety. For instance, sensors and cameras can be used to detect and prevent crimes, while GPS tracking helps emergency teams quickly reach and assist those in need. Moreover, smart city technology helps manage traffic flow and reduce congestion, fostering a safer urban environment.

One of the most crucial digital security measures is cyber-security. It involves protecting computer systems, networks, and data from theft, damage, and unauthorized access. To ensure that users feel safe in urban areas, robust cybersecurity measures should be in place. This includes the use of firewalls, encryption, and multi-factor authentication.

Digital tools have revolutionarily changed how people interact with each other, especially in urban areas. Social media platforms and messaging applications have made it easier for people to connect regardless of their physical location. This has given rise to new models of social interaction built around digital tools. For example, virtual events and meetups allow people to connect without leaving their homes.

Digital transformation has enabled the urban landscape field to become more efficient, sustainable, and responsive to citizens' needs. By utilizing digital technologies like data analytics, IoT, and AI, urban planners and architects can gain insights into how people interact with their environments, allowing them to make informed decisions on how to design and manage cities.

2.1. Digital tools and social interaction models in urban landscape areas:

a. Socio-economic effects of wi-fi

Wi-Fi allows personal electronic devices to connect to the internet without a wired connection (Baker, 2016).

The proliferation of mobile technologies and the increased accessibility of Wi-Fi enhance user engagement and interaction in public spaces, thereby boosting the allure of cities. Mobile device users have a higher level of interaction in public spaces compared to non-digital users. Wi-Fi has become an integral part of modern life, with its impacts felt in various sectors, including education, health, and business. In urban areas, its effects are particularly noticeable, with various socio-economic implications being observed. Positive effects include:

- Increased connectivity and access to information lead to increased educational and employment opportunities.
- Improved communication and collaboration between individuals and businesses result in increased productivity and innovation.



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Negative effects include:

- Increased reliance on technology can lead to potential health issues and social isolation.
- Unequal access to Wi-Fi leads to a digital divide, exacerbating existing social and economic inequalities.

Free public Wi-Fi has the potential to attract the public to urban landscape areas, including those looking to work, study, create content, or simply relax. Wi-Fi can also provide reliable communication in emergencies and when cellular networks are unavailable. However, public internet access should be securely protected and encrypted.

Contrary to concerns, digital communication in urban landscape areas doesn't necessarily hinder interaction among people. Instead, it can facilitate conversations about daily news, promote shared social activities, and allow users to share their experiences through photos and videos (Campbell & Kwak, 2011).

A study in 2010 introduced Wi-Fi services in seven major city parks in the US and Canada. Notable locations among these parks include Union Square in New York, Rittenhouse Square in Philadelphia, and Nathan Phillips Square in Toronto. The study found that:

- 25% of laptop owners had never visited these parks before Wi-Fi was introduced.
- 70% of those who had visited these parks before stated that they started visiting more frequently after the introduction of Wi-Fi.
- There were no negative effects observed from introducing Wi-Fi, meaning no users were deterred from visiting the parks because of it (Hampton, et al., 2010).

b. IoT and urban landscape areas

The Internet of Things (IoT) enhances efficiency in the management of urban landscape areas by allowing remote data collection, storage, and sharing. These technologies support sustainable management of natural resources while providing safer and more accessible environments for space users.

IoT technology has the potential to transform urban landscape areas by better managing resources and infrastructure. Some applications of IoT for urban sustainability include:

- Smart lighting systems that adjust based on human presence, resulting in energy savings.
- Smart waste management systems that optimize collection routes, reducing pollution.
- Smart transportation systems that reduce traffic congestion and improve air quality.

In 2014, as part of the "Padua Smart City" project in Padua, Italy, researchers from the University of Padua collaborated with Patavina Technologies. A sensor network consisting of 300 nodes was set up around the university area. These sensors, mounted on streetlights, measured temperature, humidity, and air quality. After a seven-day data collection period, it was observed that rainstorms led to a decrease in light intensity and temperature but an increase in air pollution and humidity. This indicated that rainstorms potentially increase traffic congestion, contributing to air pollution. This study demonstrates how different sensors can be used to determine the relationship between weather conditions and air quality (Zanella & Vangelista, 2014).



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c. Mobile applications and urban landscape areas

Mobile applications can be used for various purposes related to urban landscape areas. They provide basic information about urban landscape areas, collect data, enhance the creation of educational and social media content, and facilitate collaboration and two-way communication between users and staff.

Mobile applications can provide users in urban areas with real-time information about local events, transportation, and other services, improving their overall experience.

Mobile apps can also be used to promote community engagement in urban areas. For example, apps allowing users to report issues like potholes and graffiti can help improve the overall appearance of the city. Additionally, apps providing information about local volunteer opportunities and community events can help foster a sense of community among city residents.

According to Klyde Warren Park (2015), the 5.2-acre Klyde Warren Park in Dallas collaborated with the tech firm Pariveda Solutions to develop a mobile app to provide real-time information about the park to visitors. Features of this app included a digital event map, program information, and menus for food trucks. Users were informed about event updates and program changes through the app. The application has received positive reviews on Google Play and has approximately 1,000 downloads. This suggests that the app particularly appeals to a specific audience who frequently visit the park, especially given that the park hosts approximately one million visitors annually.

d. Geographic information systems and services

Geographic Information Systems and Services (GIS) use digital software to capture, store, process, analyze, manage, and present geographic data. GIS mapping technology offers a high potential to structure the collection, analysis, and presentation of various data types that can be used to enhance the accessibility, environmental management, community engagement, health, and management of urban landscape areas. Comprehensive installation with sensor systems may require specialist and observer managers to act upon the collected data.

Between 2012-13, the Universities of Queensland and South Australia conducted research examining the effect of urban parks in Campbelltown, Adelaide, on physical activities. The study utilized an internet-based geographic information system to collect data from park users regarding their activities and benefits derived from the park. Participants provided information by marking their activities and benefits on a digital map. The collected data was visualized to provide insights into how parks were used and to be used for urban planning (Brown, et al., 2014).

3. Digital Transformation in Urban Areas Worldwide

- Smart Dubai is an extensive initiative aiming to transform Dubai into the world's smartest city. This effort leverages cutting-edge technologies such as artificial intelligence, blockchain, and the Internet of Things to enhance the city's infrastructure, services, and the quality of life of its citizens. Key projects under Smart Dubai include the Dubai Blockchain Strategy, Dubai Data Initiative, and Dubai Paperless Strategy. These initiatives have positioned Dubai as a global leader in smart city innovation and digital transformation.
- Barcelona Smart City is a program launched by the city of Barcelona to promote sustainable development and improve the quality of life of its citizens through technology.



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The program encompasses various ventures such as smart lighting, smart parking, and smart waste management. One of the primary projects under the Barcelona Smart City program is the Superblock project, which seeks to transform city streets into blocks made up of large vehicle-free zones, turning them into pedestrian-friendly areas. The project has successfully reduced traffic congestion and air pollution, while also promoting social interaction and community engagement.

- Singapore is a smart city with advanced transportation systems and green spaces.
- Masdar is an eco-friendly city with sustainable energy and water management systems.
- Songdo International Business District is a smart city equipped with an advanced information and communication technology infrastructure.

4. CONCLUSION

Today, with the widespread use of digital technologies, smartphones, and social media, combined with the availability and opportunities of Wi-Fi in public spaces, it is believed that the use of digital applications can enhance the appeal of public landscape areas. It has been observed that mobile device users tend to spend more time in public spaces compared to non-users. This could imply a higher likelihood of the public using mobile devices. Digital communication in public areas does not necessarily inhibit interaction between people. On the contrary, it can facilitate discussions about current events, encourage shared social activities, and enable park users to share their experiences through photos and videos.

Modern mobile devices and sensors are compatible with the Internet of Things (IoT), an electronic and software network. IoT allows communication between digital devices and enables remote collection, storage, and sharing of data over the Internet. It's crucial to consider the opportunities offered by these technologies and ponder how better services can be provided in urban landscape areas. At this juncture, it's essential to identify user needs and objectives, prioritize user experiences, and take accessibility into account.

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**RECREATIONAL CAMPING AREA IN LAKE VAN AND ITS SURROUNDINGS:
THE CASE OF ÇAKIL ISLAND**

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ABSTRACT

Recently, people's return to nature has become an important focus of attention, with the concept of leisure time being valued and spent with quality. People that living in cities often turn to nature, which is outside of urban areas, to meet their outdoor recreational needs. Camping areas, which are among the outdoor recreation resources outside the city, have been in demand in recent years. It is a form of recreation carried out by making use of tents, caravan huts and similar accommodation tools in order to perform different recreational activities in nature, to rest or to stay for a short time. The landscape is at the heart of successful recreation and tourism. The unique beauty and uniqueness of a landscape closely affect its recreation and tourism attractiveness. Various existing camping areas on the shores of Lake Van within the borders of Van Province are used by those who prefer camping recreation, especially in summer. In this paper, the general characteristics of the Çakıl Island Camp Recreation area, which is one of the existing camp areas based on the coast, were evaluated. The importance of Çakıl Island, where many recreational activities such as camping, tents, caravans, daily visits and picnics are combined, makes it much different from other camping areas in terms of visual landscape quality. Solution suggestions have been made to ensure the sustainability of this camping area in line with the landscape values.

Keywords: Recreation, Camping Areas, Landscape, Sustainability, Çakıl Island.

1. INTRODUCTION

As a result of fulfilling people's different wishes and desires in terms of recreation in their spare time, different types of tourism have emerged today, and the return to nature and ecology has become a major focus of interest. According to Ryan (1991), camping activity, which is carried out in recreational areas today, has become increasingly popular in the world in recent years for reasons such as providing the opportunity to evaluate the opportunities of another natural environment at every opportunity and providing this with more economical conditions than other activities, and the fact that accommodation can be carried out in environments rich in natural and historical-cultural values. It has started to become a serious alternative to the holiday habit of owning or renting a holiday home or traveling to other countries.

The source of recreational activities carried out in nature is nature. Nature-based tourism activities are becoming increasingly popular around the world. Especially camping activities are the most preferred outdoor recreation activity by people (O'Neil et al., 2010). Camping is



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an activity carried out by using caravans, tents, huts and similar accommodation devices for purposes such as engaging in recreational activities in nature, resting or staying for a short time (Topay and Koçan, 2009). The fact that the majority of working people can take leave during the summer months and that schools are closed during the summer months make the summer months the season when the demand for camping is at its peak (Sözen and Şahin, 1988). Forest areas, water and waterfronts have an important potential for people to relax, refresh their minds and have fun (Eminağaoğlu et al., 2016). People who try to take advantage of their weekend holidays, especially to get away from the crowded city environment and busy work schedule, prefer the close surroundings of water surfaces and natural green areas. It is a proven fact that water has relaxing properties. The most preferred rural recreation areas are the coastal areas of the sea, lake, dam lake, stream and dam ponds (Akten and Akten, 2011; Eminağaoğlu et al., 2016). Water, which is a landscape element that relaxes and relaxes people psychologically, allows many active recreation activities along with its spiritual effects (Altınöz et al., 2014). In accordance with the values they carry, these areas provide opportunities for many activities such as camping, picnics, trekking, bird watching, photo safari and landscape viewing (Demir, 2001). Therefore, coastal areas are very valuable resources that can meet recreational needs (Özdemir Işık and Demirel, 2016; Aşur, 2017). Coastal areas are important activity areas in terms of visual landscape value. It is a fundamental component of the natural environment in terms of recreation and tourism and affects the overall quality of recreational and touristic activities. In this context, it contributes significantly to the regional economy and the attractiveness of the environment (Clay and Daniel, 2000; Aşur and Alphan, 2018).

1.1. Campgrounds

Camping, a recreational activity, was common among the elite in the early 20th century. Over time, this activity has spread among other socioeconomic groups. Published in the Official Gazette No. 21728 dated 14.10.1993: "Campings in the Regulation on Tourism Investment and Enterprise Qualifications; "They are facilities with at least 30 units established on highway routes and their immediate surroundings, at city entrances, in places with natural beauty such as seas, lakes and mountains, and where tourists generally meet their needs for overnight stay, food and beverage, rest, entertainment and sports with their own means." It is of great importance to evaluate regional factors in campsite planning and design. A map containing information such as main highways, water surfaces, places with historical and cultural significance, natural areas of significant attraction and long walking paths will ensure that the proposed facility is in the right location. Vegetation is the biggest resource of campsites. It is better not to lose what was originally owned, to maintain it and to avoid damaging it, than to recreate it. For this reason, before starting planning, the existing vegetation of the study area should be shown on the current maps. When choosing camping areas, climate, soil characteristics, topographic structure and accessibility are qualities that must be taken into consideration. Since camping areas are located in open areas, they should be established in areas that do not receive much rainfall and are protected from strong winds. The topographic structure of the camping areas should be chosen in a very flat place to facilitate the setting up of tents and the movement of caravans. The slight slope of the camping area prevents tent and caravan users from being affected by rainwater.

According to Sözen and Şahin (1988), topographic slopes up to 5% are the most ideal slopes for roads, structures and campsites. Slopes between 5-15% can be chosen for playgrounds and camping areas, provided that terracing or leveling is done. The distance of camping areas to



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main traffic roads is important for accessibility. In campsites established close to the main traffic network, long-term users as well as passers-by have the opportunity to spend the night in the camping area, which increases the usage capacity of the camping (Bulut, 2000). Apart from all these, the proximity of camping areas to green areas, other recreational activities and especially public service units such as water, electricity and telephone lines are factors that affect site selection (Güleç, 1990).

Coastal areas, which are open areas, are recreational areas where social interactions can be experienced with the trio of sun, sea and sand (Hall and Page, 2012). However, spatial changes occurring in coastal areas sometimes lead to the destruction of natural areas. There are outdoor recreation areas of various sizes in the coastal areas of the Van Lake Basin, allowing camping, picnics, trekking and swimming activities.

In this paper, the general landscape features and activities offered by the Çakıl Island Camp Recreation area, one of the existing coastal camping areas, were evaluated. The importance of the area was emphasized and suggestions were made to ensure its sustainability.

2. MATERIALS and METHODS

The main material of the study, Çakıl Island camping area, is located within the borders of Erciş district of Van Province (Figure 1).

The surface area of Van province, located in the Eastern Anatolia region, is 19,069 km². In the southern coastal region of Lake Van, the world's largest soda lake, in the Deveboynu Peninsula location, 38°26' and 38°29' Northern latitudes and 42°52', 42°47' Eastern longitudes and in the Mollakasım Settlement location, 38°42' and 38'. It is located between 36' North latitude and 43°11' and 43° 56' East longitudes. It is located in the closed basin of Lake Van in the Upper Murat-Van Section of the Eastern Anatolia Region. The coastline of Lake Van covers an area of approximately 430 kilometers, its deepest point is approximately 450 meters, and the lake surface is approximately 1,650 meters above sea level. Van has continental climate characteristics. Van's annual average temperature is 9°C, and while the average temperature in January, the coldest month of the year, can drop to -3.5°C, the average temperature in July, the hottest month, is 22°C. The total annual precipitation is approximately 400 mm, with 39% falling in spring, 27% in autumn, 26% in winter and 7% in summer. Snow cover can remain on the ground for approximately 90 days of the year. Van is one of the regions that receive the most sun in the country (Anonymous, 2023).



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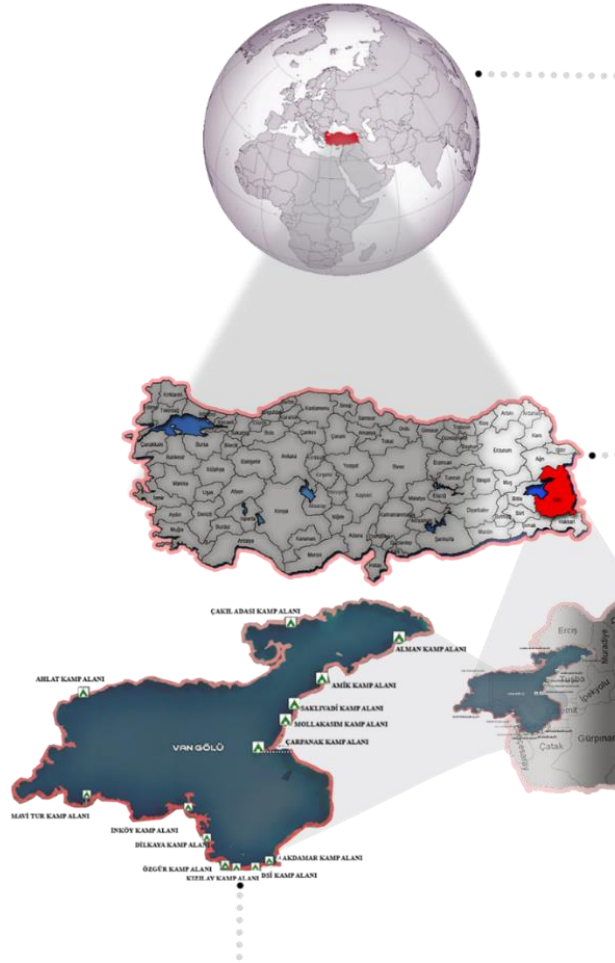


Figure 1. Location of the study area.

The method of the study is based on the literature review on the subject and the evaluation of the obtained data for the purpose of preserving and increasing the recreational usability of the area. In addition, in order to indicate the natural landscape features of the area and the uses in the area, on-site inspections, observations and measurements were made, photographs and videos were taken, and the current situation was analyzed and determined. In addition, the opinions of the people of the region, the people in the area and the operator were taken to determine their opinions about the recreational camping activity, the points they are hesitant about and the points they would support. Relevant factors that will be effective have been selected to determine the suitability of areas where recreational camping activities can be held. These; natural factors, socio-cultural factors and visual landscape factors. Accordingly, the suitability of the camping area was evaluated and interpreted, and improvement suggestions were developed.

3. FINDINGS and DISCUSSION

Çakıl Island camping area; It is located in Bayramlı village of Erciş district of Van province. The camping area is built on a small peninsula formed by white pebbles carried by the waves in an area of 18,000 m², which emerged as a result of a natural formation. This area, with an altitude of 1654m, has been operated by the people who own the land closest to the coastline

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since 2015. Çakıl Island can be defined as an area of very high visual landscape value, connected to the mainland by narrow gravel accumulation shapes called Tombolo or Saplı Island (Figure 2). It is said among the local people that the area was used as a natural harbor in the 19th century and the grapes grown in the surrounding villages were used to make wine, traveling from here to Tatvan and then to Italy.



Figure 2. Satellite image of Çakıl Island camping area.

Recreational Water Use Bacteriological lake water samples are taken from the swimming areas determined by the Swimming and Recreation Commission in the center of Van and the districts bordering Van Lake, at the frequencies specified by the regulation during the swimming season, between 15 June and 15 September, and are analyzed in the Van Public Health Laboratory, and the results are analyzed in the Van Public Health Laboratory. It is recorded in the Health Institution's bathing water quality system. The classification report for 2021 is included in Table 1.

Table 1. Çakıl Island beach bathing water quality

Year	District Name	Swimming Area	National Classification Result	Compliance with Mandatory Value	Activity status
2021	Erciş	Çelebibağı Çakıl Island Beach	A	Suitable	Aktive

(A: Very good/Excellent quality - B: Good quality - C: Medium quality - D: Poor quality) Reference: (Van Provincial Directorate of Health, 2022).



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The interpretation of the factors considered as a result of on-site analysis and observation of the area is given below. These factors are: Natural factors, Socio-cultural factors and Visual Landscape Factors.

In terms of natural factors, the region is under the influence of the continental climate and the tendency to camp is more frequent in the summer months. The hill located in the northern part of the area is covered with heavy snow during the winter months and there is a possible avalanche danger. Due to the lack of adequate afforestation on the hill, which is approximately 50-60 meters high in the north direction, there is a slight risk of landslides. Tectonic movements and volcanic activities occurring at the bottom of the Van Lake Basin were effective in the formation of the island. The camping area has a slope of 6%.

The camping area faces south, which is a suitable aspect. According to the land registry and cadastre directorate parcel inquiry with the access date of 02.04.2023, the natural formation where the island is located is an unregistered public area. The presence of a wetland with an interesting natural formation in the central part of this peninsula has provided a characteristic landscape for Çakıl Island (Figure 3).



Figure 3. Çakıl Island campsite (Original).

In terms of socio-cultural factors, it is 121 km away from Van center. Transportation to the area is via a poorly maintained dirt road, 119 km of which is asphalt and the remaining 2 km. Transportation to the island, which is 17 km away from Erciş, is possible by private vehicle. 15.4 km away is Erçiş Çelebi Bağları Family Health Center No. 2. Security measures provided by the business in the area are provided during the summer months. The existence of a camera system belonging to the business and the accommodation of the business owners in their nearby houses during the summer do not pose any security risk. In terms of adequate infrastructure, there is an infrastructure system such as electricity, toilet, shower, drinking water and potable water. Although it has a very special natural landscape feature, it has not reached a sufficient level of awareness about the area. Negative human impacts: Thanks to the intense supervision, control and maintenance of the business, it is not possible to talk about the negative impact that those who come to the area have on the environment. In terms of swimmability, clean water and swimming suitability are high. In terms of Facility Availability, the private enterprise offers market, cafe, toilet, shower, parking lot, umbrellas, sun loungers and tent camping areas for general needs. Tent and caravan camping is also possible in the available and quieter area of



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the beach. There are 50 portable pergolas and tents in the area, which can be disassembled and assembled by a private operator (Figure 4 and Figure 5).



Figure 4. Beach volleyball court at Çakıl Island camping area (Original).



Figure 5. Çakıl Island camping area beach (Original).

In terms of Visual Landscape Factors, the water of the shore of the camping area has a very transparent and clean appearance in terms of water quality. Planting was done by the company in the immediate surroundings of the area. There is no negative adjacent view in the area. There is variable surface relief in the immediate vicinity of the area. Although the camping area has unique panoramic views, the small wetland located in the middle of the area adds a different and characteristic visual quality to this camping area (Figure 6).



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Figure 6. View of the campsite on the cape of Çakıl Island (Original).

4. CONCLUSION and RECOMMENDATIONS

Tourism activities are increasing day by day around the world, and with this increase, an increase in tourism types is also noticed. For travelers looking for a difference and those who want to engage in alternative tourism activities, specially organized businesses have begun to increase in the service sector. People who are away from nature in big cities and are looking for a quiet environment have started to prefer areas where camping can be done.

This study was based on the Çakıl Island camp sample area, located on the shores of Lake Van, where the natural landscape values where land and water meet are synthesized. It is of great importance to fully preserve the unique resource values of Çakıl Island and to pass them on to future generations. Common problems experienced in other tourism and recreation areas in Turkey, such as administrative, legal, environmental, educational and economic, are also seen in this area. The most important issue that should be taken into consideration in order to ensure the sustainability of such recreation areas should be to preserve the resource values and transfer them to future generations with the understanding of protection of the natural environment. All activities and arrangements to be made in the Çakıl Island Camping area should be within the framework of this understanding. Instead of dominating nature, an approach that aims to be in harmony with nature and tries to benefit from it should be adopted.

Suggestions that will contribute to the protection and sustainability of this coastal recreational camping area are listed below:

- The shorter connection between the vehicle road and the beach will positively affect the increase in recreational uses of this camping area.
- In Çakıl Island, where the infrastructure problems have been relatively solved, tented areas are insufficient due to the high demand in the summer months. In this case, the inadequacy of infrastructure and superstructure facilities must be eliminated.
- The management of Çakıl Island and similar areas with unique landscapes should be done by experts in their fields.
- Since the best observer of an area is its user, one-on-one interviews should be held with the users of the area to be managed.



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- Vegetative strengthening of the areas close to the area will improve the coastline ecologically and increase recreational uses.
- Another issue to be taken into consideration in distributing the visits to the area throughout the year is the development of a recreational management policy to establish a delicate balance between the protection of the area and the continuation of its recreational use. In line with this policy, it would be correct to first determine the visitor profile of the area by relevant institutions and organizations.

In order to ensure the protection and sustainability of areas that are important for tourism and recreation, such as Çakıl Island, it is not correct to completely isolate this area from people. Considering that visits peak in certain periods, it is important to ensure that carrying capacities are not exceeded. The increase in the number of visitors is a positive development in the context of increasing recognition of the area and its ability to serve recreational activities. However, it would be better to spread the periods with the highest number of visitors to other suitable periods of the year as much as possible. Due to the climate characteristics of the area, the fact that the season is shorter than other touristic places with a hot climate negatively affects the tourism revenues of the region. Therefore, diversifying recreational activities to extend the season may be a solution.

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EXPERT APPROACH IN VISUAL LANDSCAPE EVALUATION OF EMRE LAKE

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ABSTRACT

Nowadays, natural areas attract more attention than before, due to the increasing population, apartment lifestyle and the physical condition of cities being away from naturalness. Landscape is undoubtedly one of the components that affect the attractiveness, identity and sustainability of natural areas as a place of connection between urban people and nature. Examining assessments of expert preferences for the visual quality of the landscape can play an important role in identifying existing landscapes with different visual value in order to preserve and regulate the condition of natural areas. In this study, it is aimed to evaluate the visual preferences of Emre Lake, which is a natural lake in the town of Döğër, İhsaniye district of Afyonkarahisar province, within the scope of biophysical landscape interactions, according to experts. Photographs of the area in expert evaluation; It was presented with questions with nine parameters: Naturalness, Worth of Protection, Diversity, Originality, Mystery, Inviting, Exciting, Impressive, Safety, Relaxing. According to the results obtained, in the direction of the landscape values of this lake, it has been tried to be discussed in the future for recreational purposes together with protection.

Keywords: Emre Lake, Expert Evaluation, Landscape Features

1. INTRODUCTION

The visual quality of the landscape is evaluated by perception and preference, the human eye and judgment. However, human judgment is often categorized as citizen versus expert. Literature reviews show that expert-based evaluation prevails over citizen-level judgment. It is possible to talk about the lack of information about methodologies to evaluate public preference of landscape and landscape qualities (Nakarmi et al. 2023).

Because landscape means different things to people depending on context and background (Antrop, 2005; Griffiths, 2018), perspectives on and preference for landscape vary greatly, and there is no universally accepted theory for landscape aesthetics (Kaymaz, 2012).

The use of photographs rather than in situ imaging of landscapes has been a widely accepted approach to assessing public preference for several years (Nakarmi et al. 2023).

The human perspective on land resources has been recognized not only as a piece of land providing food and shelter, but also as a visual resource for aesthetic, scenic and recreational values since the mid-nineteenth century. Since then, setting aside the best and unique landforms and landscapes for conservation and recreation has begun by designating areas such as national parks, reserves, areas of outstanding beauty and wild areas (Dmytrowski and Kicińska, 2022).



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The two main philosophies, objective and subjective, have been widely discussed, especially in the field of visual quality assessment of landscapes (Brooks and Lavigne, 1985). In objective philosophy, we focus on the biophysical aspects of the landscape and its characteristics such as form, shape, texture, color, liveliness, originality, pattern, etc. importance is given to its beauty from different angles (Daniel, 2001). "Biophysical landscape interactions are biotic and abiotic processes that have an impact on developments in and evolution of a landscape" (van der Ploeg et al. 2018). Both of these beauty philosophies are equally important. However, the objective philosophy has dominated landscape assessments and studies for several years compared to subjective or user-centered landscape assessments (Kvan, 2013).

Landscape preference depends on what the landscape offers (Gibson, 1979; Herzog, 1987). Affordances are "features and configurations" of landscapes. The higher the positive objectivity or beauty of the landscape, the greater the subjectivity or preference of the landscape (Peng and Han, 2018). This is information that is important for landscape planning and development.

The subjective aspect of the landscape "can be measured objectively by examining people's likes and dislikes, that is, their aesthetic preferences" (Lothian, 2017). Landscape assessment, planning and evaluation depend largely on human judgment. However, human judgment is often discussed broadly from expert and citizen perspectives (Daniel, 2001). Often, the expert's judgment is based on training and experience. It mostly lacks psychophysical aspects (Liu et al. 2018). Expert sovereignty generally involves objective resource assessment and often focuses on scientific, ecological, and physical aspects of the landscape (Liu et al. 2018). Citizen opinion is a perception-based approach where neither education nor experience and standards or frameworks are required (Daniel, 2001). Herzog et al. (1982) noted the many ways in which "citizens' perceptions and preferences differ from those of planners/experts." Daniel (2001) found that perceptions vary greatly from person to person, noting inconsistencies of opinion even among experts for the same landscape.

In Turkey, as in the rest of the world, natural areas have begun to be destroyed, a rapid change has occurred in the landscape, and concrete cities have begun to form (Akten, 2003; Yılmaz et al., 2009).

In this study, the evaluation of visual and aesthetic preferences according to experts within the scope of the biophysical landscape qualities of Lake Emre, a natural lake in İhsaniye district of Afyonkarahisar province, is discussed.

The main material of the study consists of Lake Emre, which is located as a natural lake in Döğler town of İhsaniye district of Afyonkarahisar province. Emre Lake, located between Döğler Town and Bayramaliler Village, is a lake formed by natural means.

The photo survey method is one of the most direct approaches to assessing visual quality in rural landscapes (Arriaza et al., 2004; Aşur, 2022). Photographic survey visually demonstrates the natural beauty of the landscape and allows the observer to evaluate the aesthetic appeal of the landscape. To determine the landscape value of the area, 9 parameters determined and 14 images selected from photographs taken from this area were used together to obtain expert opinions. Questions and photo scoring are both simple and straightforward methods for assessing expert preferences of landscapes and landscape features. In the study, 14 photographs of the area were selected based on visual indicators such as naturalness, worth protecting, diversity, originality, mysteriousness, inviting, exciting, impressive, safe, relaxing, which

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define the visual characteristics of the landscape, landscape preferences and experience theories. A survey was prepared to determine the criteria that experts consider when evaluating the visual quality of the landscape. These images were scored in 3 categories: high, medium and low in terms of landscape value. Using studies on this subject (Yeomans, 1983; Aşur and Alp, 2020), the scoring system was interpreted by 10 experts as 10-8 as good, 7-4 as medium, 3-1 as bad. A scoring table was created by taking the arithmetic average of the scores given, and the scores were revealed on the scale determined according to the visual landscape quality assessment of the area.

1.1. History and Features of Lake Emre

Within the borders of the cities of Afyonkarahisar, Eskişehir and Kütahya, the history dates back to B.C. It is located in the Phrygian Valley, which dates back to 750. Emre Lake is located within the borders of Döğer town of İhsaniye district and the 3000-year-old Phrygian Valley, approximately 50 km away from Afyon. The surface area of the lake is approximately 5 km² and its depth is over 3 m in some areas. Due to its geological structure, the Phrygian Valley has been the settlement of many different civilizations throughout history. As a result of the carving of the rocks, settlements and mausoleums were formed. It also attracts the attention of freshwater fishermen. The fact that the bottom of many parts of the lake is grassy creates suitable living conditions for fish, allowing them to live and feed comfortably. It is one of the places frequented by some migratory birds, especially pelicans, in April and May. Their collective movements on the lake during hunting times attract attention and are worth seeing (Anonymous 1, 2023). You can reach Emre Lake, which is 30 km away from the Gazlıgöl region, via the Gazlıgöl-İhsaniye-Döğer road route or the Gazlıgöl-Yaylabağı-Demirli-Bayramaliler road route (Anonymous 2, 2023).

2. MATERIALS and METHODS

The main material of the study consists of Lake Emre, which is located as a natural lake in Döğer town of İhsaniye district of Afyonkarahisar province. Lake Emre, located between Döğer town and Bayramaliler Village, is a lake formed by natural means (Figure 1).



Figure 1. Location of the study area.



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2.1. History and Features of Lake Emre

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3. FINDINGS and DISCUSSION

14 visuals containing the characteristics of the area, presented for the evaluation of the visual preferences of a 10-person expert group within the scope of the biophysical landscape characteristics of Lake Emre in Döğler town, are included in Table 1.

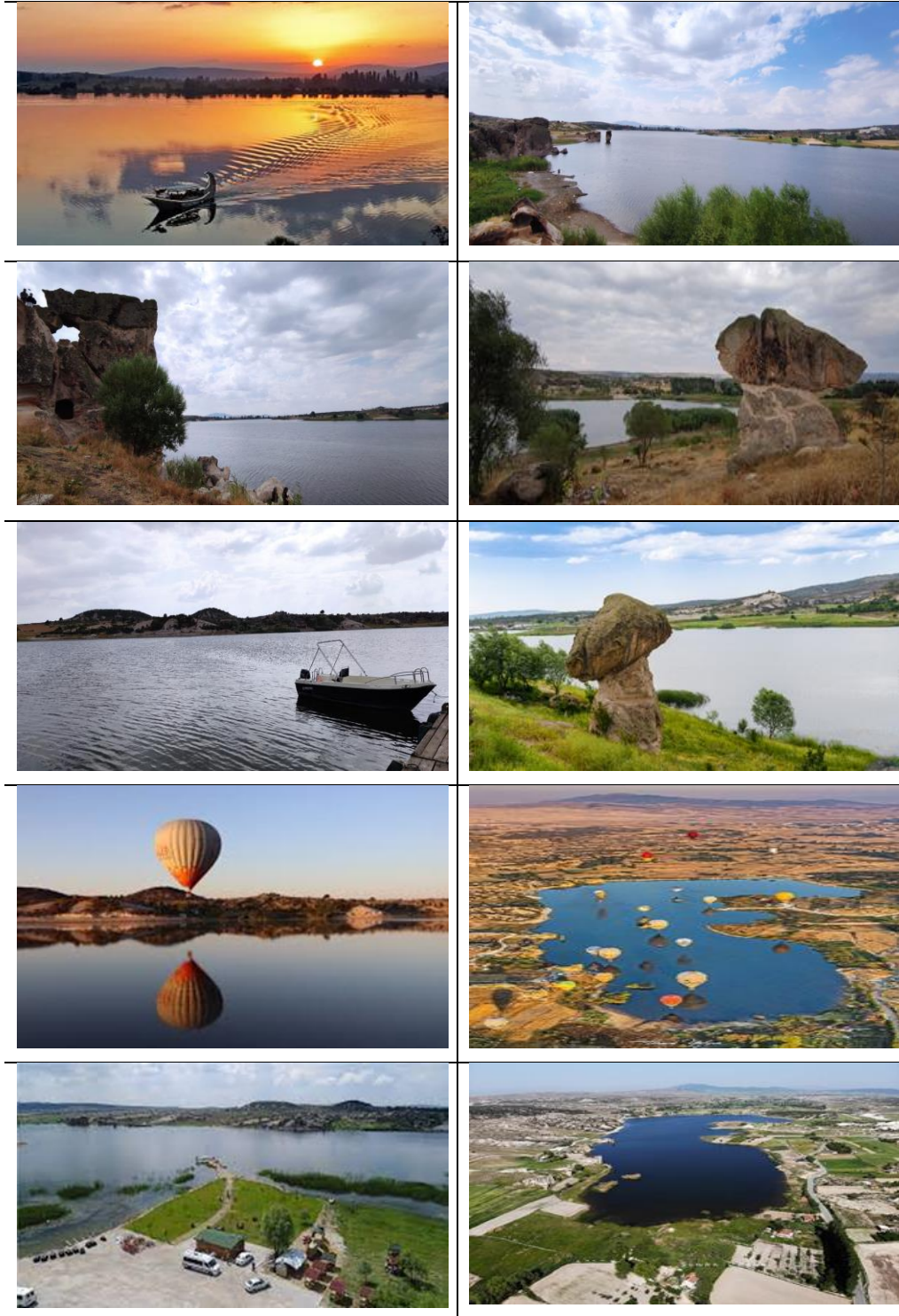


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Table 1. Images reflecting the landscape features of the area (Anonymous4, 2023 and original)





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High, medium and low categories emerged as a result of the scores given to the parameters of naturalness, worth protecting, diversity, originality, mysteriousness, inviting, exciting, impressive, safe and relaxing, which are based on visual indicators related to the landscape of the area. The result of this evaluation is given in Table 2 based on the percentage system.

Table 2. Percentage values of landscape features as a result of scoring

Parameters	Parameters Visual Quality Degrees		
	High (8-10)	Medium (4-7)	Low (1-3)
Naturalness	%20	%80	%0
Being Worth Protecting	%80	%20	%0
Variation	%20	%20	%60
Originality	%20	%80	%0
Mysteriousness	%40	%60	%0
Inviting	%20	%80	%0
Excitingness	%80	%20	%0
Impressiveness	%60	%30	%10
Security	%40	%50	%10
Relaxing	%80	%20	%0

Based on the findings of the study, this field is of high value to experts, with a rate of 80% being deemed worthy of protection and having an exciting and relaxing effect. However, it was found moderately natural, original and inviting by 80%. It was also revealed that this area has a low value in terms of diversity, with a rate of 60%.



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4. CONCLUSION and RECOMMENDATIONS

Nowadays, people are turning to rural areas, forests, waterfronts and protected areas around cities in order to meet their recreational needs in natural areas, away from the crowds of busy cities. Visual quality assessment of the landscape is used as a guiding tool that is important in the planning and design of rural and urban environments and in the formation of some managerial policies, in the context of the visual data it produces about the changes in the physical environment.

Within the scope of this study, based on the data obtained from the research findings, the visual evaluation of the landscape components of Lake Emre in Afyonkarahisar depending on different land cover was presented and correlated with their preference status. In general, literature studies have revealed that the preference of experts increases with the increase in the degree of naturalness and unique cultural characteristics in landscape scenes.

Naturalness has a strong influence on landscape preferences. Relevant stakeholders should take into consideration that Lake Emre should be worth protecting due to its natural and cultural landscape features. The fact that the naturalness of this area has a moderate value indicates that recreational uses are probably being used without considering the naturalness of the area and that the nature of the area is not paid enough attention in the landscaping works. Likewise, the low value of diversity in the study area indicates that care should be taken to ensure diversity in landscaping works to be carried out in order to provide recreational opportunities in the future.

According to the scoring study, it will help determine how the area will not lose its value in the future through conservation and recreational work. This study is a preliminary study on the landscape values of Lake Emre and its immediate surroundings. Therefore, it is recommended that more detailed and comprehensive studies should be conducted in this field in the future.

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**OUTDOOR THERMAL COMFORT ANALYSIS FOR NEW SETTLEMENTS IN
COLD CLIMATE REGIONS: THE CASE OF ERZURUM**

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ABSTRACT

Urban spaces that occupy little space on the Earth's surface are also a source of significant environmental problems. The reasons for this are shown to be urban planning and designs made without considering natural data to meet the needs of the increasing population. In this research, the settlement areas of Erzurum, an important winter tourism city in Eastern Anatolia, established at a high altitude, were analyzed in terms of thermal comfort. The city center, which constitutes the historical core, and the settlements opened for settlement, especially after the 1980s, such as Yenişehir, Dadaşkent, Şükrüpaşa, and Yıldızkent, were examined. Within the scope of the study, the historical core that includes traditional buildings and the new modern construction were compared in terms of thermal comfort. In the areas where the study was conducted, the "Davis Vantage Pro Plus" meteorology tool was installed at a height of 1.5 m, and hourly data was recorded throughout the year 2022. The PET values were calculated by analyzing the obtained data with the RayMan Pro 2.1 computer software. The lowest PET value measured during the year was -7.5°C for the historical core in January, -9.8°C for Yıldızkent, -10.9°C for Dadaşkent, -10.7°C for Şükrüpaşa, and -10.6°C for Yenişehir. In the hottest month, August, the PET values were 24.8°C for the historical core, 23.4°C for Yıldızkent, 22.8°C for Dadaşkent, 22.9°C for Yenişehir, and 22.5°C for Şükrüpaşa. According to measurements in the month of July, historic core and its surroundings were measured to be 2.3°C hotter in terms of PET values compared to newly settled areas. The use of data obtained in physical planning decisions is crucial for sustainable urbanization.

Keywords: New Residential Area, PET, Cold Region, Settlement.

1. INTRODUCTION

It is estimated that the urban population will continue to increase and reach 6.4 billion by the year 2050 (UN, 2019). This implies more housing, impermeable surfaces, and less open-green spaces in urban areas. It is essential to determine new settlement locations and consider the characteristics of urban climate during the planning and design phases in this process. Adapting to these changes and using spatial planning as a tool is seen as a necessity for cities to minimize the adverse effects of climate change and become sustainable (Carter et al., 2015).

Around the world, outdoor thermal comfort studies are conducted using various climate modeling software. Despite the numerous software models used in thermal comfort studies,



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RayMan pro 2.1 is the most commonly used in urban design studies (Potchter et al., 2018). The values obtained in the calculations for Physiologically Equivalent Temperature (PET), which is used in outdoor thermal comfort studies, are typically in degrees Celsius ($^{\circ}\text{C}$).

In cities with high living standards worldwide, hourly meteorological data obtained from devices located within the city are often used in planning (Stuttgart-Germany; Singapore). Especially, wind speed and direction within the city, street width, orientation, presence of vegetation, and building height variation depend on factors such as (Qaid et al., 2016; Kotharkar and Bagade, 2018; Yilmaz et al., 2022). According to a study conducted in Beijing, China, it has been observed that the presence of urban green spaces leads to increased PET values and positively affects thermal comfort. The most suitable time frame for city residents was reported to be between 2:00 PM and 3:00 PM (Sun et al., 2017). In a thermal comfort study based on urban forms in Egypt, it was found that there could be a temperature difference of 9.0°C depending on the building block characteristics. The study emphasized the influence of residential block forms and street canyon features on thermal comfort, but it also highlighted the need for such studies in various areas (Galal et al., 2020). It was noted that the results vary according to the topographical structure of the area where the city is located, with surface temperature studies being conducted mainly in flat areas (Goa et al., 2020). In terms of building layout, it was determined that in areas with high density and multi-story buildings, the land surface temperature (LST) increases in the city center (Li et al., 2012; Yang et al., 2018). On the other hand, in areas with low building density and a high ground area ratio, which means an abundance of open spaces, low LST values were identified (Yin et al., 2018).

In Erzurum, where the climate negatively affects living conditions, especially in the winter months, determining thermal comfort values in new settlement areas and raising awareness for urban renewal areas have been considered crucial. Therefore, in Erzurum, four different areas with dense residential structures that have been opened for settlement, especially after the 1980s, and are located in the city's development axes, have been designated as study areas. The aim is to determine the outdoor thermal comfort values of these residential areas.

2. MATERIAL and METHOD

2.1 Material

This study will be an original research project for cold climate regions both worldwide and in Turkey. Erzurum city, which has a significant 600-hectare urban renewal and transformation area and is on its way to becoming a prominent winter city brand, was chosen as the pilot region. The city is located in the northeast of the Eastern Anatolia Region, between $40^{\circ}15'$ and $42^{\circ}35'$ east longitudes, and $40^{\circ}57'$ and $39^{\circ}10'$ north latitudes, covering an area of 25,066 km². The city is surrounded by high mountains and has a basin-like topography. The elevation of the settlement area is approximately between 1800-2000 meters above sea level. According to data obtained by the State Meteorological Affairs over many years, the coldest monthly average in the city is -13.9°C , the hottest monthly average is 27.1°C , the lowest temperature recorded in December is -37.2°C , and the highest temperature in August is 36.5°C . The annual precipitation is 431 mm, with 50 days of snowfall and a snow cover duration of 114 days (Anonymous, 2020).

Within the scope of the research, four stations symbolizing different new urban settlement areas and housing structure uses in Erzurum are provided below in order. The locations of these

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stations are shown in Figure 1. The "Vantage Pro2 weather station device" was installed and calibrated at the research sites and placed within protective cages. The data recording device was placed near the nearest public unit, where it could be plugged into an outlet.

Station 1 - Dadaşkent Station: Distance from the city center is approximately 7.9 km.

Station 2 - Yıldızkent Station: This station is approximately 4.5 km away from the city center.

Station 3 - Yenişehir Station: It is located approximately 3 km away from the city center.

Station 4 - Şükrüpaşa Station: It is approximately 2.8 km away.



Figure 1. Location map of the study area and the positions of the stations: 1) Dadaşkent Station; 2) Yıldızkent Station; 3) Yenişehir Station; 4) Şükrüpaşa Station and meteorological measurement device.

2.2. Metod

Physiologically Equivalent Temperature (PET) = Fiziksel Eşdeğer Sıcaklık (FES): Bioclimatic comfort refers to microclimatic conditions in which humans adapt to their surroundings with minimal energy expenditure, feeling extremely healthy and dynamic (Fanger, 1970; ASHRAE, 1992; Blazejczyk, 1994; VDI, 1998; WMO, 1999; Matzarakis et al., 1999; Höppe, 2002; Matzarakis et al., 2000; 2007).

Thermal comfort values were prepared using the RayMan Pro 2.1 model. The PET index is derived from the equivalence of human thermal energy, making it an ideal tool when defining the thermal comfort range for different climate types (Matzarakis, 1999; Rudel et al., 2007). This index was developed primarily for outdoor spaces based on the Munich Energy Model for Individuals (MEMI) (Fanger, 1970; VDI, 1998; Höppe, 1999).

The environmental characteristics of the space where comfort values are calculated are as follows: Temperature = Average temperature: $T_a = T_{mrt} = ^\circ\text{C}$; Wind speed: $v = 0.1 \text{ m/s}$; Relative humidity: $\text{RH} = \%$; Solar radiation: W/m^2 ; Vapor pressure: $\text{VP} = 12.0 \text{ hPa}$; Cloud cover: $N = \text{Octas}$ (Mayer and Höppe, 1987; Matzarakis et al., 1999; Höppe, 1999; Matzarakis and Amelung, 2008).

Microclimate data obtained from all stations throughout the year 2022 were analyzed using RayMan Pro 2.1 to prepare graphs of PET, temperature, humidity, and wind data.



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3. FINDINGS and DISCUSSION

The thermal comfort status of these four settlement areas in Erzurum, which were opened for settlement, especially after the 1980s, and have a dense residential structure, has been examined. Microclimate data recorded on an hourly basis throughout the year 2022 were analyzed in sequence. The analysis graph for temperature is provided in Figure 2, the wind analysis in Figure 3, humidity conditions in Figure 4, and PET values graph in Figure 5.

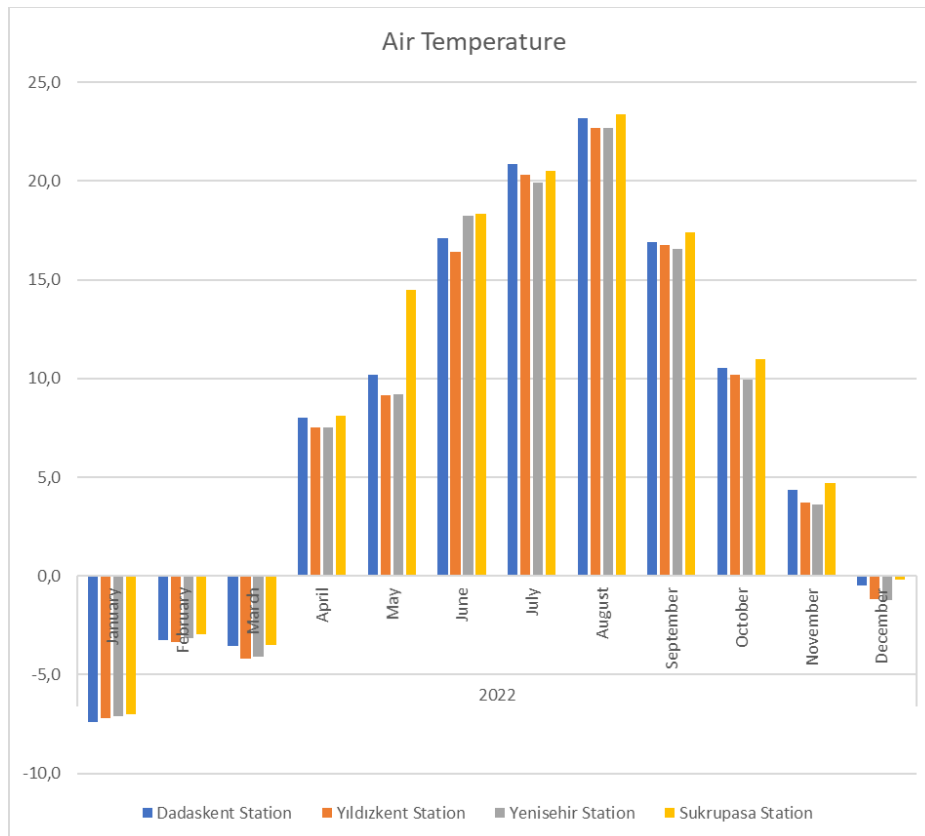


Figure 2. Temperature graph for the four stations in the study area by month in the year 2022



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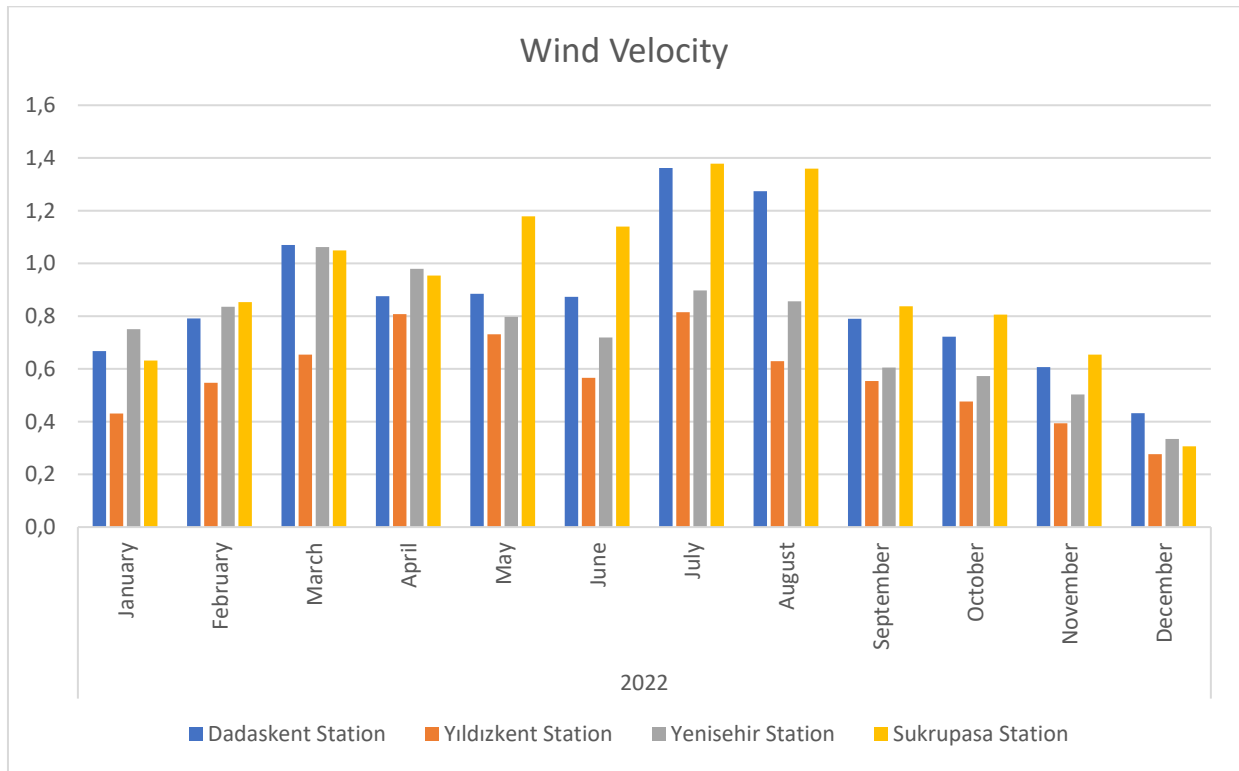


Figure 3. Wind graph for the four stations in the study area by month in the year 2022

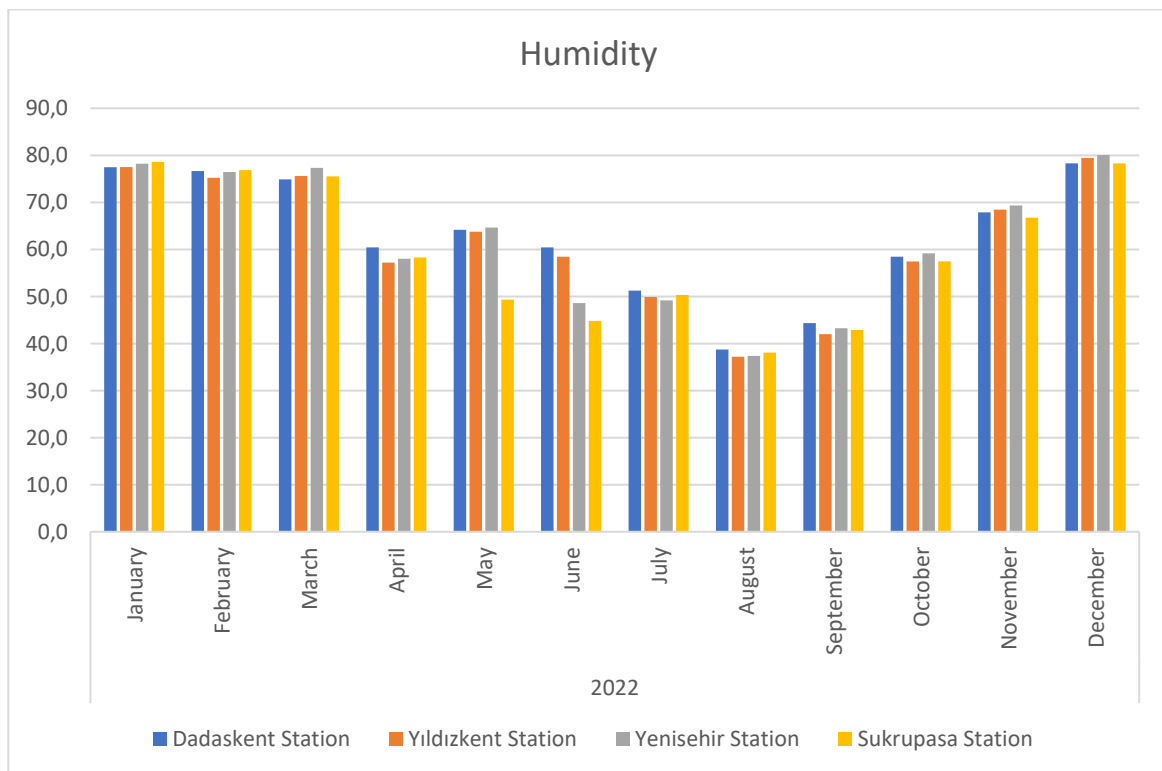


Figure 4. Humidity graph for the four stations in the study area by month in the year 2022

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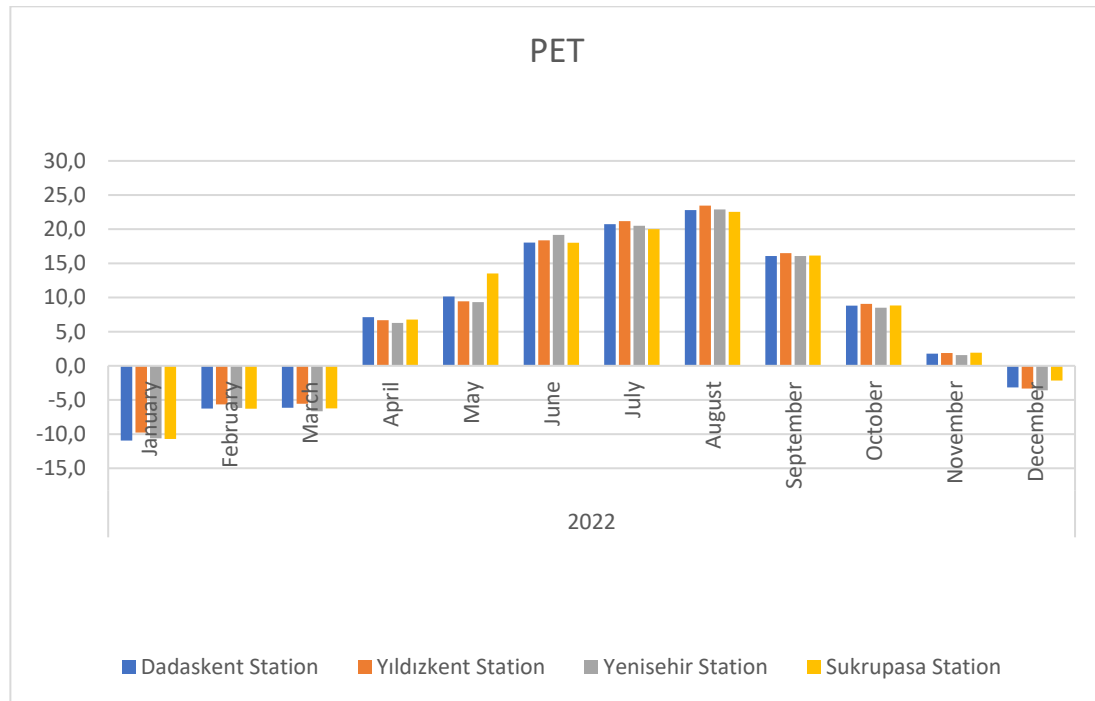


Figure 5. PET graph for the four stations in the study area by month in the year 2022

The PET (Physiologically Equivalent Temperature) frequency analysis graphs obtained from the analysis conducted with RayMan Pro 2.1 for the four stations in the study area for the year 2022 are presented in Figure 6.

The temperature data for the four stations in the study area were analyzed. In the assessment for the winter months, the minimum temperature value was determined to be -22.4°C in Dadaşkent residential area in January. Following this, Şükrüpaşa recorded -20.5°C , Yenişehir -18.2°C , and Yıldızkent -18.10°C . For the summer months, the highest maximum temperature value was recorded as 33.7°C in the Dadaşkent residential area in July. The maximum temperature data for July was 33.20°C for Şükrüpaşa, 32.70°C for Yenişehir, and 32.60°C for Yıldızkent.

According to the wind analysis values, the highest wind speed was determined to be in March for all stations. Among the stations, the maximum wind speed was found to be 6.3 m/s at the Şükrüpaşa station. Dadaşkent station also had its highest wind speed at 5.8 m/s in March. For the Yıldızkent station, the maximum wind speed of 4.5 m/s was measured in April. This value was recorded as 5.4 m/s for the Yenişehir station, also in April. Overall, it was observed that wind speeds are lower in winter.

In the analysis based on humidity values, values above 90% RH were observed in March, April, June, October, November, and December for all stations. Throughout the year 2022, the lowest humidity rate, ranging from 5% to 7% RH, was encountered in August for all stations. In terms of annual humidity data, the highest values were recorded in Dadaşkent, followed by the Yenişehir station. The Dadaşkent station has the lowest elevation among the stations, and the basin-like terrain with a high water table in this area has supported high humidity levels.



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According to the PET analysis data, the months of June, July, and August were identified as the most ideal for thermal comfort, with temperatures ranging from 18 to 23°C for all stations. The coldest stress was experienced at Dadaşkent station with a minimum of -28.9°C, while the heat stress was also attributed to the same station with 40.0°C in September. It was determined that heat stress occurred in all stations in August and September. In December, the lowest cold stress was -2.2°C, recorded at the Şükrüpaşa station. Overall, based on average PET values, it was found that Dadaşkent was the settlement area most exposed to cold stress. In this study area, which shows a planned development axis towards the west of the city, the high water table, the open plain nature of the surroundings, and the presence of low-rise buildings support cold stress (Yilmaz et al., 2022).

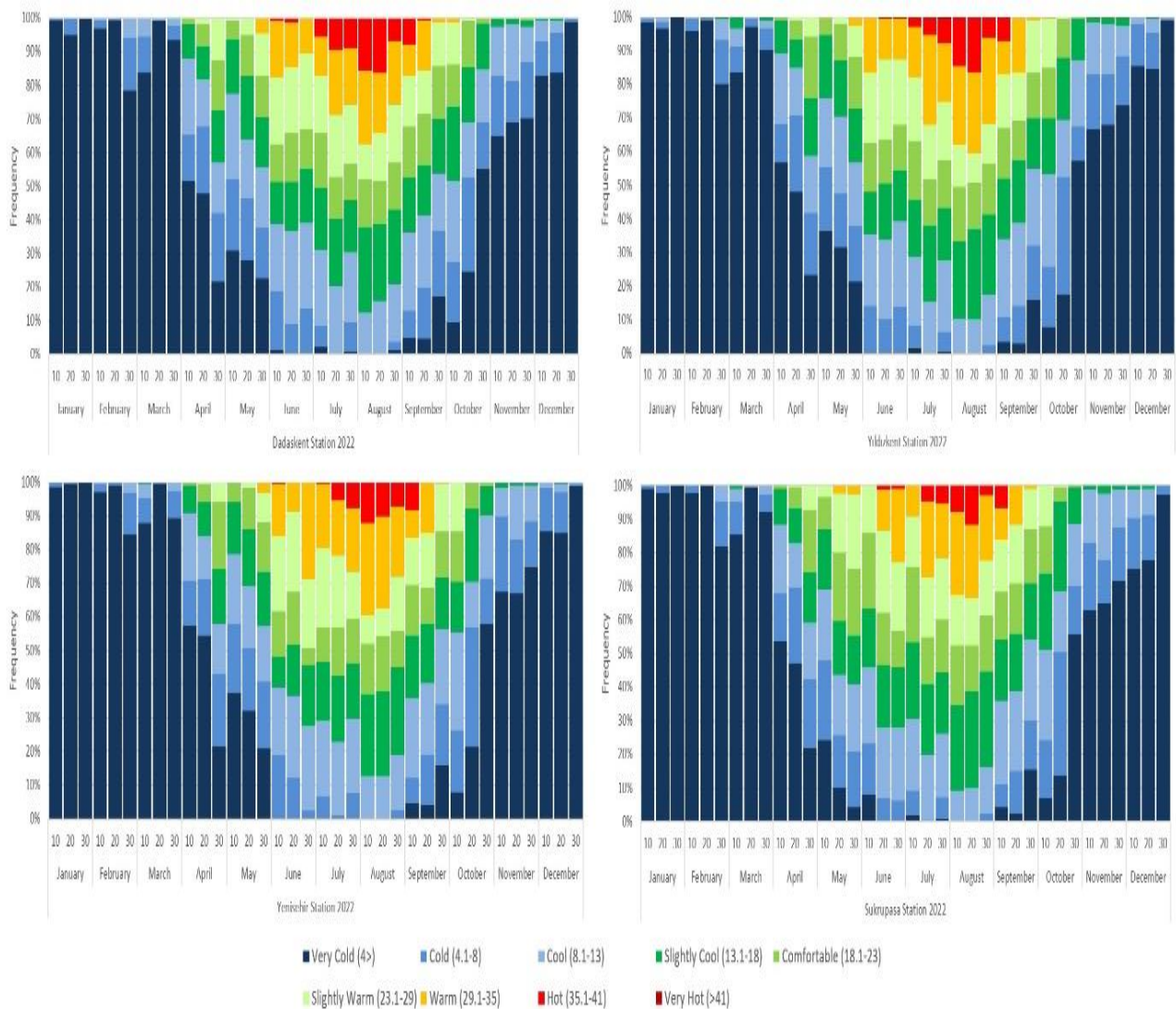


Figure 6. PET (Physiologically Equivalent Temperature) frequency analysis conducted for the stations by month.

4. CONCLUSION and RECOMMENDATIONS

In recent years, there has been increasing talk about energy-efficient, ecologically-based, sustainable, and more livable urbanization. To achieve this, it is envisaged that the natural and



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cultural resource values of the region should be identified at a micro-scale in spatial planning and used in line with the opinions of the public. Activities aimed at establishing these standards in cities are supported by local governments and relevant ministries, and efforts are being made in this field.

In Turkey, urban transformation and renewal projects are taking place in almost every province. These projects can be turned into an advantage by listening to nature and focusing on climate and microclimate-oriented planning. The need to increase residential areas to meet the growing population demand has brought about environmental issues such as impermeable surfaces and a decrease in open-green spaces. The results of the analysis have shown that it is possible to improve thermal comfort in spaces planned to be in harmony with nature. When determining new settlement areas, the natural and cultural characteristics of the area under study must be taken into account within the framework of the sustainability principle. It is generally challenging to create thermal comfort conditions in flat, open areas with high water tables and agricultural potential.

Thanks and Information Note

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**THE EFFECT OF GREEN AREAS ON THERMAL COMFORT IN COLD CLIMATE
REGIONS: THE CASE OF ATA BOTANIC GARDEN**

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ABSTRACT

The key to designing a sustainable urban environment is to develop climate adaptation strategies and produce climate projections for the future. Erzurum holds an important place among winter cities for winter tourism. The city, located at an altitude of approximately 1800 meters, experiences long and snowy winters. This study was conducted to determine the effect of green areas on thermal comfort. The Ata Botanic Garden, which is rich in green areas in Erzurum, the residential area in the city center, and an area symbolizing the rural area outside the city were determined as the study areas. A "Davis Vantage Pro 2 Plus" meteorological measurement device was installed in these study areas. The RayMan Pro 2.1 model was used for thermal comfort calculations based on the hourly data obtained. A Physiologically Equivalent Temperature (PET) analysis for the year 2022 was conducted for the green areas, city center, and rural area, based on measurements taken from green areas and the city center. In the analysis of the data, PET values were determined to be -7.5°C in the city center, -8.1°C in the Ata Botanic Garden, and -14.7°C in the station symbolizing the rural area in January. In August, the hottest month for the city, the highest PET value was found to be 24.8 °C for the city center, 23.5 °C for the green areas, and 18.9 °C for the rural area. In terms of average PET values between the city and the countryside, a difference of 5.9 °C in August and 7.2 °C in January was obtained. It has been determined that the most important factor affecting this difference is the wind. This park, which has dense green areas, has been identified as 1.3°C degrees cooler compared to the city center. The data obtained from this study will contribute to making more accurate decisions in determining healthy urbanization, transformation areas, or new settlements. Locating cities in comfortable areas, developing them towards these areas, or increasing comfort in low-comfort areas through interventions will improve livability standards in cities.

Keywords: Thermal Comfort, PET, Urban Microclimate, Urban Green Spaces.

1. INTRODUCTION

Green areas are among the most important components that add value to urban areas with their aesthetic and functional contributions. In urban areas, green spaces fulfill many functions such as increasing humidity, cooling the air, producing oxygen and clean air, filtering suspended particulate matter, energy savings, reducing or redirecting wind, and reducing noise (Walker 1991; Bradshaw et al. 1995; Aslanboğa 2002; Trowbridge and Bassuk 2004; Barış 2005; Yu



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and Hien 2006; Gill et al. 2007; Nowak and Dwyer 2000; Yılmaz et al. 2007a, b; Gómez-Munoz et al. 2010; Leuzinger et al. 2010).

One of the most prominent features of green areas in urban areas, which has recently attracted attention and has been the subject of numerous scientific studies, is their positive impact on thermal comfort and urban microclimates. Studies emphasize that thermal comfort in green areas is better compared to urban spaces (Shashua-Bar, Hoffman, 2000; Hendel et al. 2017).

Green areas, especially wooded areas, reflect a significant portion of short-wave radiation from the sun and absorb some of it, partially preventing the atmosphere from overheating during the summer months (Kayhan, 2007). This results in more comfortable areas compared to their surroundings during the winter months due to the absorbed heat (Yılmaz et al., 2019).

It is known that plants contribute positively to urban microclimates, especially through functions such as transpiration, reflecting sunlight, retaining heat on plant surfaces, shading, and reducing/directing wind. Plants largely obtain the energy they need to perform transpiration functions from the surrounding environment, creating a cooler area around the plant. Solar energy, when it hits objects, turns into heat. Plants reflect a portion of this solar energy, sending it into the atmosphere without turning into heat. They also retain some of it on leaf and branch surfaces. This provides shading and keeps the lower parts of the plant cool. The impact of plants on microclimate through their leaves is shown in Figure 1. The wind reduction and directing capabilities of plants can also have positive or negative effects on urban microclimates. When densely used, reducing wind speed can lead to an increase in temperature, while strategically designed plants, such as wind corridors, can positively affect thermal comfort in hot climates or during hot periods (Hsieh et al. 2016; Kong et al. 2017).

This study was conducted to determine the effect of green areas on thermal comfort. The study areas were determined as the Ata Botanical Garden, which has abundant green areas in Erzurum, an area symbolizing the residential area in the city center, and a rural area near the city center.

2. MATERIALS and METHODS

The study was conducted in the city center of Erzurum. In the study, which evaluated 12-month data for temperature, humidity, wind, cloudiness, and PET (Physiological Equivalent Temperature) for the year 2022, fixed stations located in Ata Botanical Garden, where there are abundant green areas in the city center of Erzurum, the residential area in the city center, and the rural area near the city center were used.

Erzurum, where the study was conducted, consists of three central districts (Yakutiye, Aziziye, and Palandöken) and has a total population of approximately 428,000 (TÜİK, 2022). The city center of Erzurum, which is at an elevation of approximately 1800 meters, is one of Turkey's most extreme centers in terms of climate values. According to the data obtained by the General Directorate of Meteorology for the years 1991-2020, the city's average temperature is 5.3°C, the annual average rainfall is 396 mm, the lowest temperature is -37.2°C, and the highest temperature is 36.5°C. The highest temperatures are recorded in July and August, while the lowest temperatures are recorded in January, February, and December. The duration of snow cover in Erzurum averages 110 days, and the average number of snowy days is 50. The average number of frosty days in the province is approximately 180 days, and the average number of clear-sky days is around 125 days. According to averages, the wind speed in the city is 2.7 m/s,

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and in the winter months, especially, the wind speed and the number of windy days decrease significantly due to the city being surrounded by mountains (MGM, 2022).

In this study, data was collected from three different areas with distinct characteristics in the city center of Erzurum using 2 fixed meteorological stations and 1 station operated by the State Meteorological Affairs General Directorate. The study area and the distribution of the stations can be seen in Figure 1.

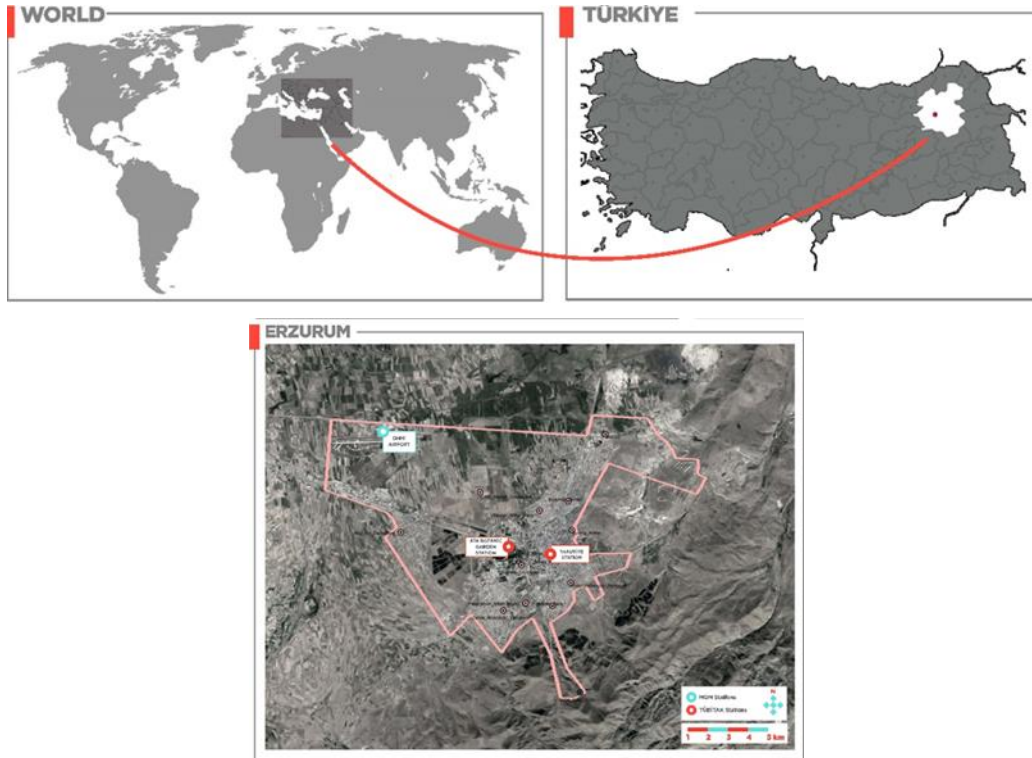


Figure 1. Location Map of the Study Area

In the study, fixed meteorological measurement devices named 'Davis Vantage Pro 2' were used. These devices measure and store temperature, humidity, wind, and precipitation data. While these devices were used in the city center of Erzurum and Ata Botanical Garden, data from the station operated by the State Meteorological Affairs General Directorate at the airport, symbolizing the rural area, was used. The calibration settings of the devices were adjusted.

Thermal comfort refers to the climatic conditions in which an individual adapts to their surroundings with the least amount of energy expenditure, feeling exceptionally healthy and dynamic (Fanger 1970). The Physiological Equivalent Temperature (PET) index is derived from human thermal energy equivalence. Therefore, the PET index is an ideal tool for calculating human thermal comfort in different climate types (Fanger, 1970; ASHRAE, 1997; VDI, 1998; Matzarakis et al., 1999; Höpfe, 1999).

With the recorded data, PET values were obtained using the RayMan Pro 2.1 model for thermal comfort analysis. Figure 2 presents the user interface of the RayMan model.

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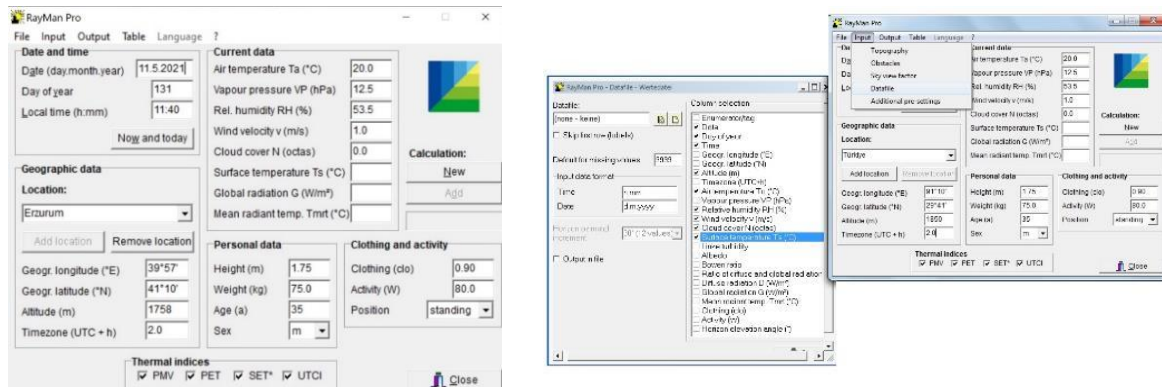


Figure 2. User Interface of the RayMan Pro Model (Matzarakis et al., 1999)

The PET values obtained from the RayMan program are evaluated according to the thermal stress categories of the PET index (Table 1).

Table 1. Thermal Stress Categories of the PET Index (Matzarakis et al., 1999)

PET (°C)	Thermal perception	Grade of physiological stress
< 4	Very cold	Extreme cold stress
4.1 – 8.0	Cold	Strong cold stress
8.1 – 13.0	Cool	Moderate cold stress
13.1 – 18.0	Slightly cool	Slight cold stress
18.1 – 23.0	Comfortable	No thermal stress
23.1 – 29.0	Slightly warm	Slight heat stress
29.1 – 35.0	Warm	Moderate heat stress
35.1 – 41.0	Hot	Strong heat stress
> 41.0	Very hot	Extreme heat stress

3. FINDINGS and DISCUSSION

The measurements conducted within the scope of the study in the year 2022 provided data on temperature, wind, humidity, cloudiness, and PET values.

When examining the micro-climate data, it is observed that the urban area has the highest annual average temperature, with 8.1°C. On an annual average, the urban area is 1.3°C warmer than the rural area and 1.2°C warmer than the green area. In the coldest month, January, the rural area is the coldest with -8.8°C, while the urban area is 2.8°C warmer than the rural area. The green area, on the other hand, has recorded temperatures 1°C higher than the rural area. In the hottest month, August, the urban area has the highest average temperature at 24.0°C, while the lowest averages are recorded in the green area at 21.0°C.



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When examining wind data, it is observed that the lowest average wind speed occurs in January and in the green area, with a value of 0.1 m/s. The highest wind speed, on the other hand, occurs in July and in the rural area, with a speed of 4 m/s.

Looking at relative humidity data, it is noted that the green area has higher humidity values compared to the other areas.

Regarding cloudiness data, a single value was used separately for each station for the relevant hours. Since all stations are located in the city center and its vicinity, the hourly average cloudiness data used by the State Meteorological Affairs General Directorate for Erzurum city was entered as the same value for all stations when calculating PET data. As cloudiness values did not vary among the stations located approximately 5 km apart, different data was not used. The cloudiness value is determined by calculating how much of the sky over the city is covered by clouds, divided into 10 parts, and this value is presented by DMIGM as a single data for Erzurum.

When the PET values obtained using temperature, wind, humidity, and cloudiness data with the RayMan Pro 2.1 program are examined, it is observed that in January, the coldest month, the rural area has the lowest values with -14.7°C . The best values in January were recorded in the urban area with an average of -7.5°C . The green area had an average PET value of -8.1°C . PET values in the green area yielded more favorable results compared to the rural area, with a difference of 6.6°C . According to the PET index categories given in Table 1, all areas are in the "Extreme Cold Stress" category in January.

When examining the hottest month, August, it is seen that the urban area has a PET value of 24.8°C , the green area has a PET value of 23.5°C , and the rural area has a PET value of 18.9°C . According to the thermal stress categories of the PET index given in Table 1, the city center is in the "Mild Heat Stress" ($23.1^{\circ}\text{C} - 29.0^{\circ}\text{C}$) range, while the green area and the rural area are closer to the comfortable range of $18.1^{\circ}\text{C} - 23.0^{\circ}\text{C}$. When annual average PET values are examined, it is seen that the green area provides the best values in Erzurum, a city known for its cold winters. The average PET obtained from the green area is 8.5°C , while this value is 8.3°C in the urban area and 2.4°C in the rural area. In terms of PET values, the green area offers more favorable values compared to the rural area by 6.1°C and compared to the urban area by 0.2°C .

When examining the frequency distributions of PET data in 10-day intervals by months, it is observed that the rural area (State Airports Meteorological Station) is predominantly characterized by very cold, cold, and cool stress levels. On the other hand, in the green area (Ata Botanical Garden) and the urban area (Yakutiye), especially during the summer months, the influence of hot stress is evident.



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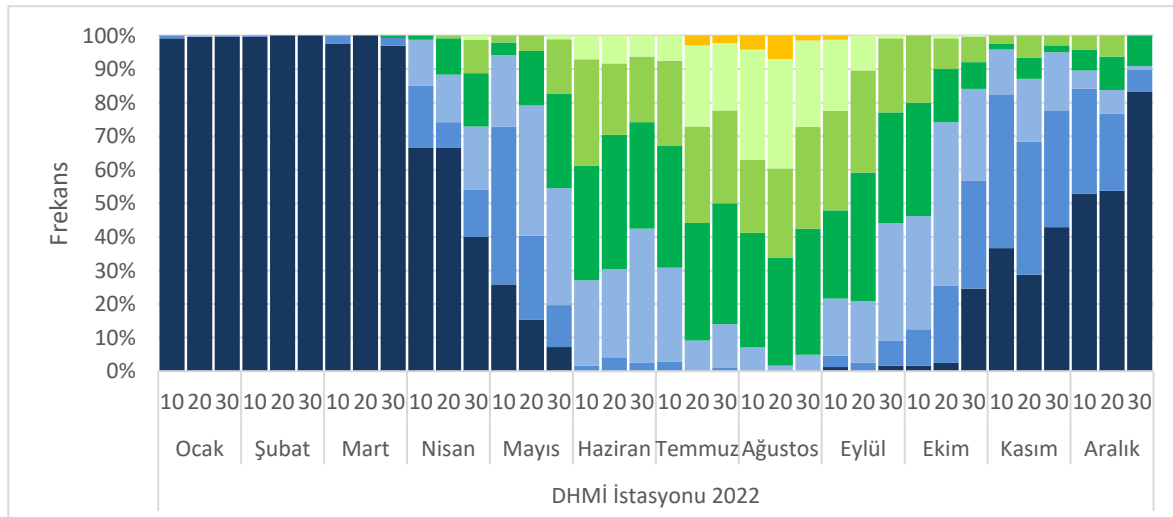
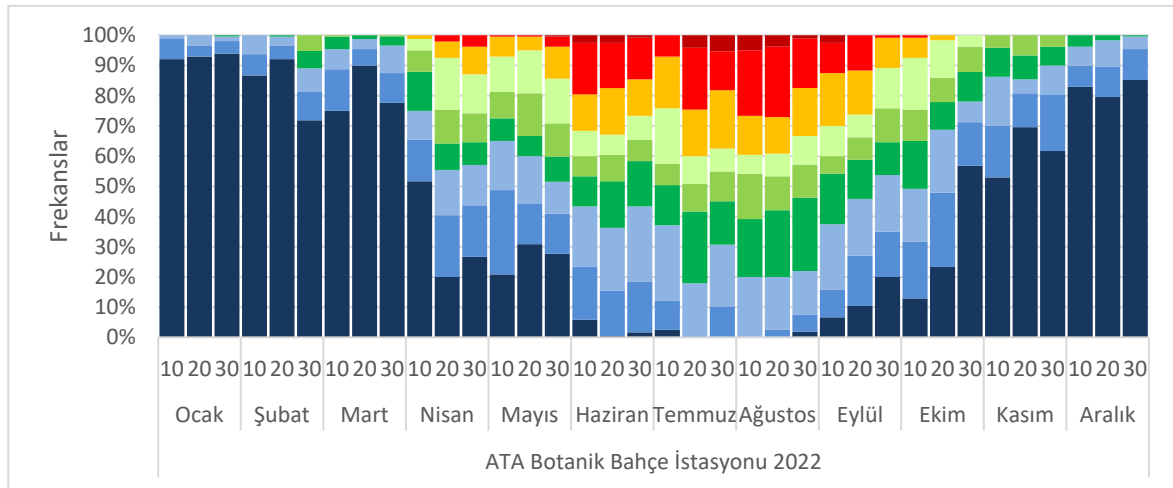
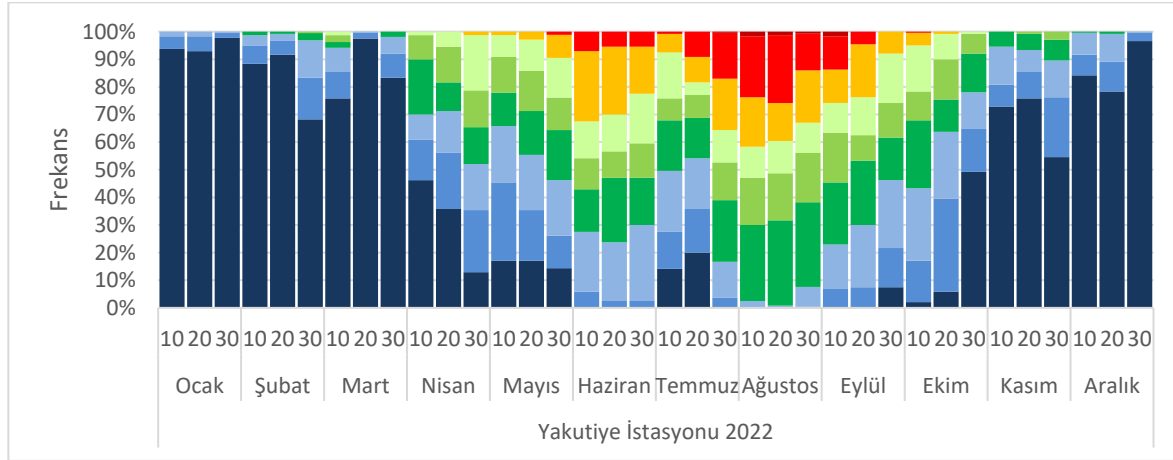


Figure 3. Frequency Distributions of PET Data by Months (Jan 1, 2022 Dec 31, 2022)



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4. CONCLUSION and RECOMMENDATIONS

As a result of this study, in terms of perceived temperature indicated by PET values, the annual average most favorable values were observed in the green area. The green area provides more favorable values compared to the rural area by 6.1°C and compared to the urban area by 0.2°C . During the winter periods, the urban heat island effect leads to the most favorable results in the urban area, while the green area also provides values close to those of the urban area. PET values in the green area yield more favorable results compared to the rural area, with a difference of 6.6°C . In the summer season, the urban area approaches an average of 25.0°C , which can lead to temperature stress, while the green area comes significantly closer to the comfortable range of $18.1^{\circ}\text{C} - 23.0^{\circ}\text{C}$.

In a study by Yilmaz et al. (2019), conducted using thermal cameras to measure surface temperatures, in winter months, Scots Pine (*Pinus sylvestris* L.) and Birch (*Betula alba* L.) communities and measurements taken from snow-covered parking lots provided the best thermal comfort, with Scots Pine (*Pinus sylvestris* L.) communities being on average 1.8°C warmer. It was found that the surface temperature emitted by the snow-covered parking lots was on average 3.2°C cooler than the others. The study demonstrated that in cities with harsh winters, the establishment of coniferous tree groves is more conducive to creating a more comfortable microclimatic environment with the aim of providing thermal comfort.

Differences in thermal comfort between urban and rural areas are expected, and most studies on this topic have yielded similar results, indicating that the city is always warmer (Asur, 2019; Gülyas et al., 2006; Bulut et al., 2008; İbrahim et al., 2019). Hsieh (2016) emphasized that urban areas are 8.5°C warmer than rural areas in terms of average temperature values. Similarly, Sharmin and Steemers (2015) evaluated climate parameters over a 2-year period for urban and nearby rural areas and noted that the rural area had average temperature values 1.7°C lower.

This study, which evaluates urban, rural, and green areas, has produced parallel results with similar studies. The results of this study have highlighted the importance of green areas for urban microclimate, specifically in Erzurum, a city known for its harsh winters.



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EVALUATIONS OF THE SESSION OF HOUSE OF COMMONS OF UNITED KINGDOM ON THE WAR AFTER THE GALLIPOLI LANDING

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ABSTRACT

The Ottoman Empire participated in the First World War as an ally of Germany. This situation caused the Dardanelles to become the primary target of the Allied Powers. Britain, who wanted to get the Ottoman Empire out of the war quickly and cost-effectively, put into practice the plan to cross the Straits with the navy and to take Istanbul. Thus, Britain aimed to keep it in the war by establishing a connection with Russia, and also to seize Istanbul with a fait accompli. However, the attack of the British and French navy on the Dardanelles turned into a great defeat. Thereupon, Britain decided to support the naval attack with land forces. As a result of the preparations, the Gallipoli landings started on April 25, 1915. As a result of the strong resistance of the Turkish soldiers and the critical interventions of Mustafa Kemal Bey, they could not get the desired result without allies, and the war turned into a frontal struggle. This situation caused an anxious wait in the House of Commons, which was waiting for the news of victory in a short time. The deputies, who could not hear from the region due to the censorship imposed by the British Government, started to suspect the British defeat as a result of the news in the German press. For this reason, the censorship policy of the British Government began to be criticized. In this study, the debates about the Dardanelles War and the British Government's censorship policy in the House of Commons after the Gallipoli campaign were analysed.

Keywords: Gallipoli, World War I, Britain.

1. INTRODUCTION

When the Ottoman Empire entered the First World War, the Dardanelles became one of the primary military targets for the Allied Powers. Russia, which needed British and French support, requested its allies to open the Straits (Altıntaş, 1999, 13). Britain and France, who were concerned about Russia's withdrawal from the war, had to take action on this issue (Eyicil, 2009, 319).

Britain aimed to take the Ottoman Empire out of the war quickly and cheaply by seizing the Straits, to establish an anti-German coalition in the Balkans, to keep the Russian Army in the war by providing military support to Russia, and finally to purchase Russian grain to feed its own army (Çetinoğlu, 1994, 725). In addition, Britain took advantage of the request for help and wanted to take advantage of the opportunity to take control of Istanbul, which Russia had wanted to capture for a long time (Sayılır, 2003, 91).

As soon as the Ottoman Empire entered the war, the British navy started attacks on the Dardanelles. Navy-based attack plans against Dardanelles were accepted by the British War Council only in January 1915 (Robbins, 2005, 48-49; Akça, 2006, 3). In this plan, warships were designed to neutralize Turkish cannons and mine search ships to destroy mines in the



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Dardanelles (Edi, 2018, 3). Thus, it was aimed to keep the Ottoman Empire out of war in a short time.

The attacks, which had been continuing since November 1914, reached their peak on March 18, 1915. At the end of the day-long battle, the allied navy had to retreat, accepting that it could not pass the Strait (Eyicil, 2009, 330; Taşkıran, 2001, 21).

Considering the Ottoman Empire as an easy target, Britain implemented a new plan, this time involving land forces. It was envisaged to silence the Turkish artillery with the landings in the Gallipoli Strait and thus to quickly destroy the defenceless mines. After the destruction of the mines, it was decided that the navy would take over Istanbul (Mütercimler, 2021, 78).

The landing operation for Gallipoli started on 25 April 1915. First, landings were made in Arıburnu, Seddülbahir and Kumkale regions (Mango, 2004, 179). The aim of the clashes in Kumkale was to stall the Turkish forces. The aim was for the forces advancing from the Seddülbahir and Arıburnu regions to capture the Kilitbahir plateau and collapse the Turkish defences in Gallipoli (Birinci Dünya Harbi'nde Türk Harbi Çanakkale Cephesi, 2012, 11).

The event that largely determined the fate of the Gallipoli landings took place on the Arıburnu front. After the ANZAC forces landed in the region managed to hold on to the shore, they began to advance, taking advantage of the lack of sufficient soldiers against them. However, Mustafa Kemal Bey's initiative to stop the ANZAC soldiers advancing on the Arıburnu Front changed the fate of the war. Despite the bloody struggle that lasted for months, there was no serious change in this region, and the possibility of the British achieving their goals was eliminated (Babüroğlu, 2021, 195).

Although the Turks had a small number of soldiers in the Seddülbahir region, they managed to resist the numerically superior British throughout the day. The Turkish line had to retreat due to the possibility of being surrounded by British soldiers advancing from bays where there were no soldiers. However, the British could not achieve their goals as the Turkish forces retreating from the Seddülbahir region organized a new defence (Mütercimler, 2016, 295, 303; Volkan, 2011, 139).

Unable to make any progress, the allies launched the Kerevizdere attack on 21-22 June via Seddülbahir in June. Despite the fierce battles that continued throughout June, the Turks managed to defend the front (İlhan, 1994, 679; Aydemir, 2011, 226).

The House of Commons, which expected a quick victory after the landing, could not receive enough information about the war due to the government's censorship policy. Although positive expectations from the war continued in various sessions, news in the foreign press fuelled the discussions. Under these conditions, a session was held in the House of Commons on 30 June 1915 to evaluate the Gallipoli War and the censorship policy of the British Government.

2. MATERIALS and METHODS

The main source of this study is the minutes of the session held in the House of Commons. The minutes of the session subject to the study were obtained from the British Parliament Archives. These minutes were examined within the historical methodology. The speeches in the session were interpreted and, when necessary, information was given about historical events that were necessary to understand the subject. In the conclusion part of the study, evaluations were made about the topic discussed in the session.



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3. FINDINGS and DISCUSSIONS

Sir Henry Dalziel was the first to speak at the session. Sir Henry Dalziel recalled the statement made by the Secretary of State for the Home Department and made evaluations on this statement. The Foreign Secretary stated that the army and navy made statements based on the ongoing war situation and did not share some information due to the security of the soldiers. Sir Dalziel said that this information came from the authorities in London and that it was unclear how reliable it would be since it was not received from local authorities. He stated that the statements of the Press Office in London were satisfactory. He underlined that the Press Office shared the information forwarded to it from various institutions, and said that if the information was censored, it was a government decision. He claimed that every member of parliament would understand the government's censorship of some information regarding the course of the war. Sir Dalziel accepted that it was up to the incumbent government to decide what information, good or bad, was or was not in the public interest. However, despite everything, he stated that he preferred the government to make more frequent statements (UK Parliamentary Archives, 1915, 1895-1896). During the war, every country censored information containing military details and news of failures in order to keep the morale of the people high and to ensure the safety of the soldiers at the front. However, although the war has been going on for months and a new front has opened in Dardanelles, inadequate information about the war seems to have disturbed some politicians.

The British Government decided to censor information about the war for military security reasons. Although the House of Commons understood this decision, the fact that very little information was shared about the war started to make MPs nervous. These concerns about censorship were expressed in this speech.

Continuing his remarks, Sir Dalziel asked whether the Foreign Secretary would make a more detailed statement about the military situation in Dardanelles shortly. He stated that his goal was not to discuss the military situation in detail in parliament, and that he doubted whether this would be useful. He stated that military operations were continuing in Gallipoli, but detailed news about this issue appeared in the German press. For this reason, he argued that it would be quite logical for the government to convey information that is in the public interest to the parliament as soon as possible. Sir Dalziel stated that there were many allegations regarding the landing that needed to be discussed. He argued that the attack made before the landing and the claim that the Turks were warned for defence should be discussed. He asked the government to make a more detailed statement as soon as possible. Sir Henry Dalziel stated that if the government trusts the people more, the people will trust the government more and fulfill what is asked of them better (UK Parliamentary Archives, 1915, 1896). The Gallipoli landings aroused great curiosity in Britain. The fact that the Germans shared various information on this issue and the spread of news about the failure of the British undoubtedly increased the demand for information about the war in the House of Commons.

In Britain, the War Council approved the plan to attack the Dardanelles with only the navy at its meeting on January 13, 1915. In this plan, it was decided that the warships would neutralize the Turkish cannons and then destroy the mines left in the Dardanelles. This plan was accepted in its final form on January 28 (Ünalp, 2015, 40). However, it should be noted that the British navy carried out some attacks on the Straits before this plan was approved.



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The claim in the speech in the House of Commons that the naval attacks on Dardanelles gave the Turks the opportunity to prepare against a land attack is noteworthy. As a matter of fact, the Ottoman Empire has accelerated the fortification of the Straits since the attacks that started in November. As the expectation of a land attack increased after the naval attacks intensified, the Turkish defence in the region was considerably strengthened (Volkan, 2011, 134). This situation is expressed by many soldiers who served in the region, including Mustafa Kemal Atatürk. It is impressive that British politicians realized this when the ground offensive had just begun and they did not have a healthy flow of information about the war.

Sir Arthur Markham reminded that the Secretary of State for the Home Department claimed that the information leaked by the Germans was false and for propaganda purposes and therefore censored. Asking how correct it was to hide the information that the enemy knew and published in the press from the public, Sir Markham stated that the people endured all kinds of sacrifices, including sacrificing their lives in this war. Therefore, he argued that it was pointless for the government to want to pursue a policy of censoring publicly known information. He criticized the current government's censorship policy, arguing that previous governments had not sought the authority to hide unwelcome information from the public, even during war. He stated that it was wrong to hide the information about the Gallipoli War, which Germany and the German people were well aware of, from the British people. Sir Markham argued that it should be disclosed to the parliament how many fronts were established in Gallipoli and what Sir Ian Hamilton reported to London. He also stated that many media organizations sent reporters to the region to follow the war and that the government prevented this information from reaching Britain (UK Parliamentary Archives, 1915, 1897-1898).

From this speech, it is understood that the censorship and the lack of adequate explanations about the war seriously disturbed the politicians. In particular, the German press' various news about the war not only created discomfort among politicians, but also led to the suspicion that there was a defeat in Gallipoli. In addition, the censorship of the news of the reporters sent by the newspapers to the war zone was not received very positively.

Sir Markham stated that while the people endured such sacrifices, Parliament had the right to know how the war was going on. Otherwise, he demanded an explanation of what caused the government not to share the information. Stating that strikes and wage disputes continued in the country, he argued that if the government had provided detailed information about the war, these economic struggles would not have occurred. He stated that members of parliament have learned a little about the war, but people who sent their children to war have not received any information about the war. Sir Markham held the Secretary of State for War, Lord Kitchener, responsible for the censorship that had continued since the beginning of the war. He claimed that he did a good job recruiting soldiers, but that his censorship decision was wrong and harmed the country. Instead, he recommended that existing armies focus on solving their logistics problems. He stated that the censorship originated from the Ministry of War and that it was inappropriate to criticize the press on this issue. Stating that the former government made the decision to censor with the advice of Lord Kitchener and that the current government continues this, Sir Markham argued that this decision should be changed. He requested that military experts come and convince parliament that censorship of existing information is inevitable if the practice is to continue (UK Parliamentary Archives, 1915, 1898-1900).



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During the war, all countries implemented censorship. Apart from this, Sir Markham claims that providing adequate information about the war will have a better impact on the public. Undoubtedly, although censorship concealed the failures, it also led to increased gossip and the public's focus on the troubles brought by the war. In other words, it caused harm as well as benefit. Despite this, governments have continued the practice that has been going on since the past.

Sir Markham stated that even the names of the regiments sent to Gallipoli were not disclosed, but German spies gave these names to the German press. Stating that the people deserve to hear the truth after all their sacrifices, Sir Markham claimed that the government's silence only led to chaos (UK Parliamentary Archives, 1915, 1900). Censorship has been met with criticism, especially in a society accustomed to freedom of the press and the flow of information. This can be noticed from the speeches in the House of Commons.

The Secretary of State for Home Department Sir John Simon stated that army and navy officials decide on the information to be shared before an announcement is made on military matters. He stated that the Press Office worked hard on this issue and worked devotedly to share appropriate information with the public. Explaining that a large team of experts decides what information will be shared, Sir Simon gave an example of a soldier's letter. He explained that the Germans bombed that area 24 hours after one of the soldiers described the view in his letter describing the position he was defending and this letter was published in the press. Although he acknowledged that the application of the rules could occasionally lead to errors, he argued that censorship was important for the safety of fighting soldiers. He claimed that the policy implemented was supported by the entire government and stated that any information that could be useful to the enemy was censored (UK Parliamentary Archives, 1915, 1901-1902).

The main thesis of those who advocated censorship during the war was to ensure the safety of soldiers on the front. However, censorship was also used to hide negative developments from the public. Undoubtedly, since this situation was known to the public, long periods of silence were perceived as defeat. Rather than demanding that all information be openly published, critics of censorship have argued that all information should be shared except that which would endanger the safety of soldiers.

Sir Simon claimed that there were good developments regarding Gallipoli and requested that the information spread through the German Government or the press should not be relied upon. He stated that the German Government was deliberately spreading distorted information and making propaganda in its favour. He claimed that the Germans were trying to influence neutral countries in this way. Sir Simon also stated that if the anti-British news in the German press was reflected in the British press, it was used as propaganda material by the Germans in neutral countries. Sir Simon argued that the claim that no information was given about the Battle of Gallipoli was not true, and stated that a long news story about Sir Ian Hamilton was published on the day of the session. He said that this news was about the developments that took place in the war two or three days ago. He argued that the news coming from the fronts were examined quickly and those deemed appropriate were published without delay (UK Parliamentary Archives, 1915, 1903-1904).

During the war, countries not only implemented censorship, but also carried out propaganda activities aimed at the public opinion of enemy countries. Countries have used censorship to



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prevent this. Apart from this, it is also clear that governments only want to announce military victories and cover up failures through censorship.

Sir Simon stated that there were positive developments in the Battle of Gallipoli and that the Royal Infantry and the Scots carried out successful attacks. Sir Simon continued his remarks by quoting from Ian Hamilton's report. He explained in the report that the Turks launched attacks against the British trenches, but these attacks were repelled thanks to machine gun and artillery support. He stated that according to the report, more than the expected progress was achieved and Turkish attacks were ineffective. According to the report, he stated that the successful attacks of the 29th Division were the main factor in the progress. Sir Simon stated that this report is satisfactory for both the parliament and the country. Underlining that there are differences between the situation in Gallipoli and Flanders, Sir Simon stated that it was not possible to expand the front in Gallipoli due to geography. He stated that the war could not be managed by the parliament and asked for trust in generals and military officers. (UK Parliamentary Archives, 1915, 1904-1905).

As a result of the defence plan implemented by the Germans in Gallipoli, the British and French managed to hold bridgeheads on the coast. Turkish attacks to drive the invaders into the sea were not really successful. However, the Turks made a successful defence and prevented the advance of the Allied forces. The progress mentioned by Ian Hamilton was quite short-lived.

Sir Simon also spoke about the censorship of news sent by newspaper reporters from the Gallipoli Front. He also argued that information thought to endanger the military situation was censored in line with the opinion of the military authorities. He stated that the news sent by reporters from Gallipoli will continue to be examined and only those deemed appropriate will be shared with the public. He stated that similar actions were taken in every region of the war, and that no special application was taken for the Gallipoli Front. He argued that the information collected by reporters in the war zone was analysed by military authorities in the region and censorship was decided there. He claimed that no new action was taken in London over the censored reports coming from the region. However, he stated that if an important overlooked issue is noticed, a second censorship may be applied. Stating that the appropriate reports sent by Ian Hamilton will continue to be disclosed to the parliament, Sir Simon announced that the same information will also be shared with the press (UK Parliamentary Archives, 1915, 1905-1907).

It is understood from Sir Simon's speech that the British censored the news sent from the war zone both in that region and in London. The fact that the censorship on the Gallipoli Front, rather than the censorship on the Western Front, was discussed in the session shows that the Gallipoli landings were followed with enthusiasm in the House of Commons. It is also noticeable that providing limited information regarding the landing increases the suspicion of defeat.

4. CONCLUSION

When the British planned the naval attack on Dardanelles, they were excited for an easy victory against the Turks. The British public did not believe that the Ottoman Empire, which had been defeated by small states during the Balkan Wars, would be able to resist the British navy.

After the British navy accepted defeat on March 18, 1915, action was taken to support the naval attack with land forces. It was planned to capture the Gallipoli peninsula and neutralize the



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Turkish cannons with the landings to be made through Seddülbahir and Arıburnu. The Allied attack started on April 25, 1915. Although they made progress on the Seddülbahir front, they were eventually stopped by Turkish forces, which marked the end of the British's advances on the southern front. The fate of the Battle of Gallipoli was largely determined when the advance of the ANZAC forces on the northern front was stopped by Mustafa Kemal Bey.

Wanting to cover up the failures, the British Government imposed intense censorship on the news about the Gallipoli War. Suspicions peaked when the House of Commons, expecting an easy victory against the Turks, could not receive information about the war. For this reason, shortly after the Gallipoli landings, discussions began in the House of Commons regarding the censorship applied in the war. This shows that the House of Commons wanted to follow the Gallipoli landings closely. The British Government continued to censor news about Gallipoli, using military security as an excuse. Even the articles of the reporters sent by the newspapers to the region were censored both in the war zone and in London. In addition, the government shared minor progress in the region with the parliament. However, the small amount of sharing for the front has led to doubts about success. The news published in the German press also increased the unrest of the British MPs.

Considering the session on censorship, it is noticeable that the positive expectations of the House of Commons for the Gallipoli War began to disappear as early as June. The British Government's censorship decision further increased the negative feelings of MPs. The news in the German press about the defeat of the British further fuelled the concerns. The most striking point is that, in addition to criticizing the government's censorship policy, doubts about the defeat in the war were expressed in the session and accurate inferences were made about the possible reasons for the defeat.

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DEGENERATION OF THE NEST CONCEPT: CHANGES IN PEOPLE'S HOUSING TENDENCIES

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ABSTRACT

Human has been building for centuries. They create a house by carving a rock, a hut from a tree branch, a mud brick that brings water and soil together and putting what is in nature on nature again. These actions were initially carried out to protect, hide and improve living conditions as the basic instinct of the need for shelter. However, in the historical process, it has left its place to a system based on overconsumption by producing more than it needs over time, just like in the war of human with nature. With the modernist era which tends to consume rather than produce, the concept of peoples housing tendencies, which is assimilated as a home physically and psychologically, has turned into a standardized and ordinary housing concept. Especially with the modernist era which tends to consume rather than produce, the housing concept tendencies has also changed. Analyzing the change in human habitation in the evolutionary process; first of all, it requires understanding people and thinking about the construction of human-made spaces. Because; It is important to read the semantic connotations of the concept of home through the spatial analysis of philosophy, which takes its priority from the way of thinking of people, and to reveal its change. The main purpose of this study, which is prepared on the basis of this problem, is; The aim is to reveal the changing priorities and features of modern man's act of building to dwell, and thus to draw an evolutionary schema of the degeneration of the concept of home. In this context, firstly, Gaston Bachelard and Martin Heidegger's philosophical perspectives on the concept of housing are examined and the changing meaning of the concept of housing is revealed through the philosophy of space.

Keywords: Martin Heidegger, Gaston Bachelard, Dwelling, Resettlement, Build.

1. INTRODUCTION

Home is our living space where we hide on earth. This need for hiding, which initially arises from physical environmental conditions, points to an order based on protecting our self and soul in the modern age. In this context, the house has become a shelter similar to the medieval cellars of the modern world.

"Home", which is the abode of our memories and moments, is a place where we place our memory (Bachelard, 2013). It shapes and imprisons our memories by witnessing our moments with our dreams that it determines in concrete and abstract terms and the place it has acquired in our minds. The space bounded by this concept cloud constitutes the parts/rooms of our home.

However, with the modern age, housing, which has become uniform and shaped by passing through the mass production line, has lost its spatial meaning and has become an object of consumption. The uniqueness of individuality has become increasingly similar to each other in housing areas, each of which has become a copy of each other. This situation harms not only

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individual diversity but also the subjectivity of streets and the cultural identity of cities. In summary, the concept of home is the degenerated shelter of the modern age.

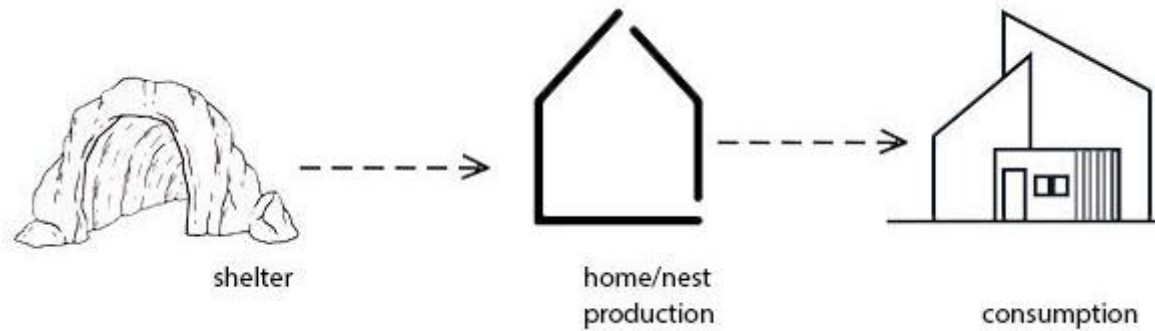


Figure 1. Evolutionary Scheme of the Nest

2. MATERIALS and METHODS

The main purpose of this study is to search for the lost meaning of the concept of home by revealing the changing priorities and characteristics of modern man's act of building for shelter. In this context, Gaston Bachelard and Martin Heidegger's perspectives on the concept of home are analyzed. The human-space-time analysis of the concept of home based on the literature review is analyzed through modern examples that seek a new meaning for home.

Gaston Bachelard, who defines space in a poetic language beyond concrete descriptions or abstract analogies, explains in his work *The Poetics of Space* how language, the main element of this poetic approach, freezes space in time and solidifies it into an image (Bachelard, 2013). In this context, according to him, the overlap of human-space-time is most clearly possible through the depiction of the house on memory and memories because home is the place where memories and dreams are most intensely engraved in our minds. In other words, the house as a place witnesses all our moments and creates memories. Bachelard, who says that even in a new house a whole past lives on, defines "home" - and therefore space - as a "place" that produces memories. According to him, space is the memory of individuals, and this memory is formed by the furniture, the smell and texture of the furniture, and the human experience of these senses. By being furnished with dreams and memories, memory spaces cease to be a physical "object" and into an essence (Leach, 1997).

Heidegger believes that dwelling, which has been lost in the modern world, constitutes the essence of human existence (Sharr, 2013). He explains that the simplification, decontextualisation, standardization and transparency of the home as a result of modernisation processes have turned people into "existential strangers" in the world. Stating that the housing crisis, especially as one of the global effects of World War II, has become a housing problem in the world age, Heidegger emphasizes that, with a similar understanding, the meaninglessness of cultures, lives and artifacts arises from the same source (Sanrı Doğan, 2022). Unlike Bachelard, Heidegger looks at home not as a reflection of happy memories, but as a reflection



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of inner troubles, and in this context he criticizes the modern world in particular (Heidegger, 1971).

3. FINDINGS and DISCUSSION

The transformation of the home into an object of consumption is a current topic of discussion in interdisciplinary art and design studies. In this context, many manifesto-like works have been put forward. In this section of the study, these works are analyzed.

- **Splitting, Gordon Matta Clark, 1970**

In the 1970s, when the deconstructive design language had not yet become widespread worldwide, American architect and artist Gordon Matta Clark used a deconstructive style in which he cut, separated and exploded some floors or structural elements of abandoned buildings and in this context reproduced the space in question (Barria, 2011). Just like Derrida's understanding of deconstruction, the concept of "detournement", in which Clark's work is intertwined, endeavors to critically target the relationship of the capitalist order with the social masses and to create an incentive to realize the questioning of social space. Clark thinks that for a conceptual interrogation in the production of spaces and the subject of spaces, language, as a condition of the control mechanism of social ideologies, must also be displaced, and in this respect, he exhibits a similar attitude with Derrida (Yılmaz, 2022).



Figure 2. Splitting, Gordon Matta Clark, 1970 (Can, 2017)

In this context, Gordon Matta-Clark has reproduced the modern "house" from an inverted perspective. Like Heidegger, he rejected the decontextualized, commodity-like structure of housing and based his designs on the movement and temporality Heidegger advocated. Clark, who is interested in social problems in his designs, focuses on the main problem area of "home" with an unusual perspective and reproduces "home" with striking fiction (Sanrı Doğan, 2022).



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- **Rachel Whiteread's House, 1993**

The artist Rachel Whiteread, who chose a house in a residential area planned to be demolished by the British government for the purpose of publicization, created a sculpture to be exhibited in its current location by making a mold of the house (Cohen, 2018). This work is an unspoken manifesto of the rebellion of people who refused to leave their homes for many years but eventually had to leave their homes. The interior walls of the house, which had already been ordered to be demolished, were covered with concrete and the bricks on the exterior were removed one by one from this concrete skeleton. In Whiteread's work, rooms that are never entered, doors that do not open, windows that do not look anywhere symbolize the freezing and solidification of "home" as a meaning in a temporal context. With this sculpture, space becomes a mental image beyond representing a physical object as a house.



Figure 3. Rachel Whiteread's House Street Facade, 1993 (Cohen, 2018)

- **Basic House, Martin Azua, 1999**

Martin Azua has created the Basic House prototype with the idea of a pocket-sized private dwelling as a counterpoint to the problems of ownership and the difficulties of home ownership. As a "foldable, inflatable and reversible" volume, the house offers a new alternative to the modern concept of property. The artist wanted to create an immaterial house in response to the fact that housing today is the end product of a series of consumption habits of our living spaces. This structure, which adapts to natural conditions, can swell with sunlight and air, and protects from cold when reversed, is based on the basic requirements of shelter. In this context, from a Heideggerian perspective, it reveals a method of having everything without having nothing (Azua, 2012).

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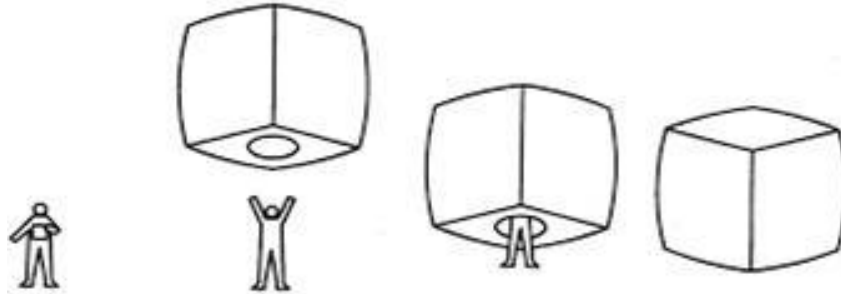


Figure 4. Basic House Working Principle Diagram (Azua, 2000)

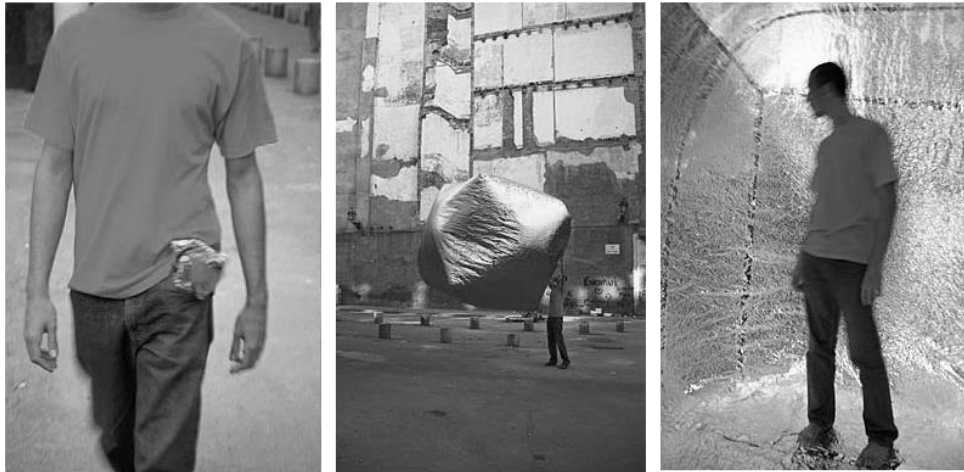


Figure 5. Basic House Phenotype, 1999 (Rosenfield, 2012)

4. CONCLUSION

The house, as a shelter and a place of living, turns into a home only when it is identified and subjectivised as a whole with memories. The human being produces that space with the desire to be at home and return home. In this state of being, home and subject are one. However, the new housing order of the modern age has made this subjectivity ordinary and easy from an objective point of view. The house has now become a companion space that pursues material concerns.

As a result, housing, which is constantly produced as a copy of each other in today's modern metropolitan cities, is becoming an object of consumption that does not allow for any experience and hosts rootless memories. The decontextualization of spaces creates societies without memory. In this context, it can be said that housing, which provides the opportunity for socialization, encounter, meeting and acquaintance, has become a new design problem.

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Mekan Tartışmaları " published at the end of the semester, and all my friends with whom I took the course.

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MICRO LANDSCAPE DESIGN IN URBAN AREAS

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ABSTRACT

Cities are laboratories where many disciplines carry out studies and they are important places where multidisciplinary studies are carried out. In this context, the study has assumed a unique value by showing a micro-scale approach to landscape design in urban areas. Micro landscape design is a process that pays attention to details, scale and balance and aims to make the best use of the available space. Micro landscape design, which increases the aesthetics and functionality of cities, contributes to the quality of urban life and is realized in small- scale and carefully considered areas. The design focuses on maximizing the environment by using small areas effectively. It saves time and energy, often requiring less maintenance than larger landscapes. This design, which is advantageous in terms of flexibility, offers solutions supported by various equipment. Micro landscape design is an important type of landscape design due to its advantages such as aesthetics, low maintenance, economical, environmentally friendly and suitable for personal preferences. Taking these features into account, the scope of this study is to explore sample urban areas for the applicability of micro landscape designs and to develop design proposals for these areas. Thus, it is aimed to provide a perspective for the inclusion of neglected areas in the city with the design discipline and to provide a perspective for the transition to large-scale landscape designs by addressing landscape design at the smallest scale.

Keywords: Landscape Design, Micro Design, Urban, Urban Design.

1. INTRODUCTION

Urban areas function as a kind of laboratory where experts from various fields come together and interact with different disciplines. This implies that cities can play a significant role in addressing complex and diverse issues from social, cultural, economic, and environmental perspectives. Cities facilitate collaboration among individuals from different areas of expertise to understand and solve various problems.

There is no consensus among theorists, scientists, and researchers when it comes to defining a city. This lack of consensus arises from the variability in criteria used to define a city. A city is a densely populated settlement that spans a relatively large space and exhibits continuity in space, comprising individuals who do not necessarily share social similarities (Keleş, 2016).

Altaban (2018) defined the urban phenomenon with different approaches such as economic location, formal-intuitive design, perceptual, social and historical, urban morphology. According to the economic site selection approach, he emphasises the importance of economic factors in urban planning by examining factors such as land use, land values and accessibility in the definition of the city. The formal-intuitive design approach is based on the assumption that there is a definite relationship between the physical environment and activities and that the designer can play an effective role in shaping society. The perceptual approach is concerned



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with the spatial and physical components of the city and emphasises the importance of how the city is perceived. It enables the creation of quality spaces by providing a balance between the elements of the city and using them in diversity. The social and historical perspective treats the city and its parts as outcomes of societal production processes, closely linking urban history to societal and economic structures. Urban morphology approach considers the city from both physical and social aspects, highlighting a continuous and inseparable interaction between physical form and social processes, forming the basis for urban morphology (Altaban, 2018).

Based on the definitions provided for the urban phenomenon, cities are seen as complex and dynamic spaces that consist of various components. These components include physical infrastructure elements such as streets, buildings, parks, and transportation systems. The harmonious coexistence of these components is vital for maintaining the functionality and aesthetic integrity of cities. This is where urban design comes into play.

Urban design is not limited to planning the physical environment; it also shapes the social and cultural structure of the city. This discipline is critical not only for the aesthetics of cities but also for improving the quality of life, safety, and well-being of individuals. Consequently, urban design is recognized as a critical tool for understanding the complexity of cities, developing sustainable, human-centered solutions, coordinating and integrating the physical and social structure of the city.

Madanipour (1996) defines urban design as the management of change within built and natural environments. From this perspective, urban design is closely related to macro-scale urban planning. However, when urban design is considered as the design of small urban areas on a micro-scale, it aligns with the aesthetic and spatial interests of architecture and the arts (cited in Aydın Türk, 2016).

Urban design is an approach used to shape the physical and social structure of cities at different scales:

- On a macro scale, it focuses on urban morphology and the perceivability of the city, developing strategies for detailed description of public space obstacles.
- On a meso scale, it includes revitalization, improvement, and revitalization of the urban fabric based on various data such as social, cultural, physical, and more. It also aims to regulate the physical environment of large-scale housing designs in new development areas.
- On a micro scale, this approach includes design principles that enable the inclusion of architectural products and the immediate environment in the social and physical environment.

Therefore, urban design theory and practices are used to support the sustainable and human-centered development of cities by considering different dimensions (Aydın Türk, 2016).

Urban quality of life depends not only on economic prosperity but also on various other factors. Strategies for improving urban quality of life include increasing green spaces, creating accessible and sustainable transportation systems, improving infrastructure, and optimizing public services. These strategies offer solutions that enhance urban quality of life, enabling people to lead happier, healthier, and more satisfying lives. Improving urban quality of life



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encompasses the effort to transform cities into places where people can live better, healthier, and more sustainable lives (Tükroğlu & Koramaz, 2016).

Urban planning and design are legal documents that guide decision-making regarding the preservation, renewal, and development of areas within and around the city. Urban design provides a general framework for the direction of change in public spaces (Özer, 2017). As Karaman (2008) puts it, urban design includes the process of applying criteria in social, economic, ecological, and morphological areas that determine the dynamics of urban development to physical space.

In this context, this study emphasizes the potential of landscape design from the perspective of urban design to make aesthetic and environmental improvements in overlooked areas of urban texture. Within the scope of this study, the potential is evaluated through micro-landscape design to beautify and increase the sustainability of urban environments.

Micro Landscape Design and Its Characteristics

In urban areas, landscape design refers to the process of arranging and enhancing open spaces, parks, streets, squares, and other green or open areas in cities. This design encompasses factors such as environmental arrangement, vegetation arrangement, aesthetic planning, and usability.

In urban areas, landscape design encompasses subtopics such as aesthetics and visual appeal, environmental sustainability, user experience, reduction of social isolation, health and well-being, climate change and water management, preservation of cultural and historical values, traffic regulation, and economic development.

Throughout history, landscape and environmental design began with the existence of humanity. People started shaping their living spaces according to their needs by settling in nature. Landscape design, initially in the form of small-scale garden arrangements, evolved into larger-scale designs to prevent environmental degradation with the increase in human settlements (Yaşar & Düzgüneş, 2013).

In urban areas, landscape design is an essential tool to enhance the livability of cities, improve environmental sustainability, and promote higher quality of life for people. Landscape design combines natural and artificial elements to plan and arrange outdoor spaces both functionally and aesthetically. This often involves a large-scale process, addressing general issues such as how large areas will be organized, where plants will be placed, and how road networks will be designed. However, in addition to this large-scale approach, micro landscape design holds significant importance.

Micro landscape design emphasizes the smallest details of landscaping. Considered complementary to comprehensive planning, micro landscape design aims to enrich people's interactions with natural and artificial spaces. In this regard, the basic principles of what micro landscape design is and how it is a process can be summarized as follows:

- **Attention to Details:** Micro landscape design focuses on small-scale details, including elements such as plants, decorative features, and other particulars of landscape design.
- **Scale and Balance:** It ensures that the design is aesthetically balanced and harmonious. Achieving balance between large and small elements is necessary to obtain visually pleasing results.



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- **Efficient Use of Existing Space:** Micro landscape design aims to make the best use of the available space. This involves optimizing the use of space and minimizing unnecessary gaps, ultimately aiming to provide maximum functionality and aesthetics in a small area.

In other words, micro landscape design aims to optimize the smallest features of a landscape and ensure that these details work together in harmony. The general characteristics of the micro landscape design approach can be outlined as follows:

Evaluation of Overlooked Areas: Often focusing on areas that are neglected or underutilized in urban spaces and examining how these areas can be improved through landscape design. It can contribute to making cities more efficient and aesthetically appealing.

Enriching the City with Design Discipline: Emphasizing how these overlooked areas can be incorporated into the city using design discipline. It can contribute to the enhancement of cities both aesthetically and functionally.

Creating a Perspective for Large-Scale Design: Expressing how micro landscape design can provide a perspective for large-scale landscape designs, starting from small-scale details. It aims to consider how small-scale design decisions can contribute to the overall urban design.

There are various areas within urban centers where micro landscape designs can be implemented. These areas vary depending on their locations and functions in the urban fabric. Examples of areas suitable for micro landscape design include, but are not limited to, narrow streets, unused spaces, courtyards or rooftop terraces of apartment buildings, areas integrated with urban furniture such as sidewalk benches, trash bins, or bicycle parking spaces, and the vicinity of public transportation points such as bus stops, train stations, or tram stops (Figure 1). Improvements made in these areas through the micro landscape design approach play a crucial role in coping with urban congestion, preserving the natural environment, and helping people avoid the stress of city life.



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Figure 1. Examples of Urban Micro Landscape Design (URL, 1)

Mikro Landscape Design, like macro and meso scales, cannot be precisely defined in terms of physical space; rather, it can be described by various other terms in the context of urban areas, including:

- Urban botanical areas
- Urban micro-green spaces
- Details of urban landscaping
- Urban gardens
- Urban green pockets
- Small-scale urban landscaping
- Small landscape compositions
- Mini park (pocket park)
- Miniature urban nature arrangement
- Street landscaping
- Urban miniature landscaping

The choice of terminology for micro landscape design can vary depending on the context in which it is used and the specific characteristics of the design.



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Regarding the conceptual diversity in micro landscape design, Gina (2016) presented examples at macro, meso, and micro scales. Urban development projects at different scales have emphasized the potential to enhance urban quality of life, strengthen connections, and improve environmental and economic health through open space and infrastructure improvements. An example at the micro scale is the area known as "Lawn on D," which was constructed as a vibrant and temporary open space. This space includes a spatial layout and programming designed to express and test the goals of the new region. Created with limited investment, this micro-scale open space has become a powerful example and pioneer in achieving more with fewer resources, inspiring other projects. Additionally, it is considered an experimental space that supports uses beyond traditional park programming, serving as a gateway to increase public participation and satisfaction (Figure 2).

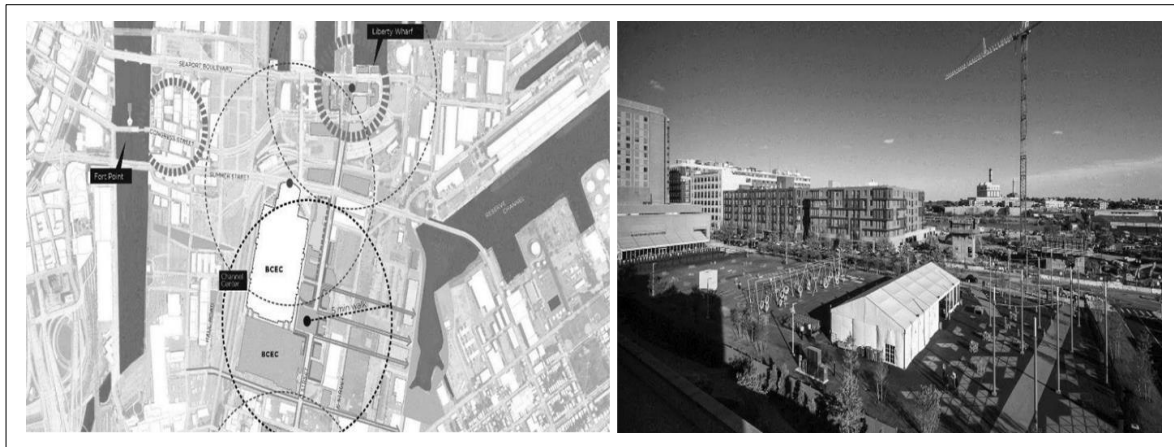


Figure 2. The urban context of the sites the Massachusetts Convention Center Authority (MCCA) oversee in South Boston

In this study, Hamdy & Plaku (2021) provides another example of conceptual diversity in micro landscape design. The focus of this study is on the concept of 'mini parks,' and its characteristics are explained. Mini parks are defined as small landscape areas that fill vacant lots or unused spaces in areas where property interest has been overlooked. These areas have been described in the literature using different terms such as mini-parks, vest-pocket parks, or neighborhood parks. In 1963, Robert Zion proposed the use of mini parks as small-scale environmental restoration elements in densely populated urban areas in an exhibition titled 'New Parks for New York.' In this context, Paley Park, which served as a model for mini parks worldwide, was constructed in 1967 (Johnson & Frankel, as cited in Hamdy & Plaku, 2021).

Another example of conceptual difference for micro landscape design is the study by Hamdy & Plaku (2021). In this study, the focus was on the concept of mini parks and the characteristics of this concept were explained. Mini-parks are defined as small landscape areas that fill vacant land areas or unused areas where real estate interest is overlooked. Such areas have been described as mini-parks, vest-pocket parks or neighbourhood parks under different names in the literature. In 1963, Robert Zion proposed the use of mini-parks as small-scale environmental restoration elements in dense urban areas in an exhibition titled "New Parks for New York". In this context, Paley Park, which serves as a model for mini parks around the world, was built in 1967 (Johnson, & Frankel, 1991 cited in Hamdy, & Plaku, 2021).



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Micro landscape design is often recognised as an important component in the creation of mini parks or pocket parks, but micro landscape design and mini parks refer to different concepts. Micro landscape design is concerned with the planning and implementation of plant arrangements, landscape elements and details in small areas.

On the other hand, mini parks or pocket parks are small public spaces that aim to create green spaces in limited areas, usually in cities. Such parks are organised using the principles of micro landscape design, but micro landscape design is not limited to mini parks; it is also a concept used for general landscape design. The elements that bring these concepts together are listed as follows.

- Small Scale Design: It is related to small scale design and arrangements. Both usually require working in limited areas.
- Plant Arrangements: Micro landscape design and pocket parks are related to plant arrangements and landscape elements. The selection of plants, their arrangement and maintenance are important in both cases.
- Aesthetic Value: Both concepts require aesthetic attention. Both micro landscape design and pocket parks aim to enhance environmental beauty and aesthetic value.
- Usability: It aims to create areas that people can use and enjoy. Seating areas, walkways and similar features are important in terms of usability.

Advantages and Features of Micro Landscape Design

Micro landscape design consists of a process that includes a wider range of design elements, including a seating unit, ground covering, boundary element, plant arrangements as a component. In this process, there are various advantages such as flexibility, support with equipment, aesthetics, low maintenance, economic, environmentally friendly and suitability to personal preferences.

Flexibility Advantage: A flexible approach to micro landscape design can offer solutions that suit different areas and needs. This makes it easier to customise the design and adapt to existing conditions.

Supporting with Accessories: Micro landscape design is made more functional by supporting it with various accessories and elements, enriching the design aesthetically and functionally.

Other Advantages: Aesthetics, low maintenance, economic, environmentally friendly and suitability to personal preferences come to the fore.

Aesthetics: Micro landscape design provides aesthetically attractive and visually satisfying results even in small areas.

Low Maintenance: The design is characterized by low maintenance requirements, reducing maintenance costs.

Cost-Effective: It offers economic advantages, even on a smaller scale.

Environmental-Friendly: It can include environmentally friendly solutions in line with sustainability principles.

Compatibility with Personal Preferences: The design can be customized according to personal preferences and cater to users' desires.



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Micro Landscape Design Process

Based on the information conveyed regarding the characteristics, advantages, and definitions of micro landscape design, there are several stages for implementing micro landscape design in urban areas, from site identification to post-implementation. These stages include site analysis, microclimate and soil analysis, area usage decisions, integration with urban fabric, accessibility analysis, sustainability evaluation, ease of maintenance, and ensuring user engagement.

Site Analysis: The initial step in micro landscape design involves a detailed analysis of the urban area. This analysis meticulously examines the size of the area, existing landscape features, environmental conditions, and intended use. Factors such as the size, shape, existing vegetation, and environmental factors like the direction of sunlight and wind are considered during this stage.

Microclimate and Soil Analysis: Micro landscape design requires a detailed evaluation of the climatic and soil conditions of the area. In this context, microclimate characteristics of the area such as sunlight intake, wind direction, temperature changes should be determined and soil analysis should be carried out. Climate and seasonal conditions are critical for plant selection and therefore, it is necessary to select plant species suitable for the climate of the region. At the same time, the soil structure of the area should be analysed and factors such as soil drainage, nutrient content and pH level should be evaluated in order for plants and landscape elements to grow properly.

Land Use decisions: Micro landscape design involves defining the various use zones of the site and developing unique micro landscape designs for each zone. For example, recreation zones, picnic areas, playgrounds, etc. should be considered separately for different zones. According to the intended use of the area, the type of activities and user needs are important.

Compatibility with Urban Texture: Designing by taking into account the surroundings of the area and nearby structures and should be compatible with the urban texture. Factors such as architectural style, environmental elements, other structures in the area, roads and walkways play a role in shaping the design.

Accessibility: Increasing the use of the area and ensuring that everyone can benefit from it is important in terms of easy accessibility and comfortable use.

Sustainability: Micro landscape design should consider the principles of sustainability. Sustainability principles such as water conservation, use of local materials and protection of natural resources should be at the centre of the design.

Ease of Maintenance: In order to ensure that the design is easy to maintain, attention should be paid to the selection of plants and the arrangement of elements. Measures should be taken to facilitate maintenance.

Participatory Design Approach: In urban area design, the opinions of local residents and users are of great importance. Adopting a participatory approach in the micro landscape design process and considering the views of the local community can help align the design with community needs and preferences.



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2. CONCLUSION

In an era of rapid urbanization, the preservation of natural areas and the creation of green spaces have become increasingly crucial. Making cities greener and more sustainable is achievable through proper design and planning. Micro landscape design provides an area where urban dwellers can effectively contribute and engage. In this context, micro landscape design plays a key role in supporting the health and sustainability of our cities.

In a world where green spaces are diminishing, micro landscapes shine as a way to create small-scale green areas and promote biodiversity. Micro landscape design not only encourages the preservation of green areas in cities and the creation of new ones but also improves air quality, maintains temperature balance, and contributes to water management. Moreover, it enhances the psychological and physical well-being of individuals while bringing communities together.

Through this study, the critical role and potential of micro landscape design in cities have been explored. Urban planners, designers, and local authorities should consider micro landscape design as a priority that needs to be integrated and encouraged. Using this valuable tool is essential to build sustainable cities and better prepare for the future.

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**THE EFFECTS OF GAMMA IRRADIATION ON THE COLOR AND
CHLOROPHYLL CONTENT OF ST. AUGUSTINEGRASS**

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ABSTRACT

*The experiment was carried out to investigate the effects of gamma-ray irradiation on the color and chlorophyll contents of St. Augustinegrass (*Stenotaphrum secundatum* (Walt.) Kuntze). Two distinct clonal genotypes of St. Augustinegrass, exhibiting coarse ('G') and extremely coarse ('M') textures, were subjected to irradiation at varying dosages of 0, 50, 100, 150, and 300 Gy and 0, 20, 40, 80, and 120 Gy, respectively, using a ⁶⁰Co source. The study included a total of 15 mutant lines exhibiting a dwarf growth pattern. In order to determine the potential differences in turfgrass color between mutant lines and non-irradiated control plants, color measurements were performed on the leaves of five randomly selected shoots using a Minolta Chroma Meter. The chlorophyll content of leaves was assessed using a randomly selected 15 shoots with a Chlorophyll Meter. The amount of color differences seen in mutants was relatively lesser in comparison to those documented for other species of turfgrass or horticultural crops. No significant differences in chlorophyll content were found among mutant lines and control plants of the M genotype. Nevertheless, the chlorophyll content of the mutant lines, specifically G20-2, G40-6, and G120-1, exhibited a reduction of around 20% when compared to the control group within the G genotype. The utilization of gamma-ray radiation, known for its role in promoting diverse pigmentation and coloration in horticultural crops, did not yield the anticipated beneficial outcomes in St. Augustinegrass.*

Keywords: Mutation, Turfgrass, Plant Breeding, Radiation

1. INTRODUCTION

St. Augustinegrass, scientifically known as *Stenotaphrum secundatum* (Walt.) Kuntze, is a perennial turfgrass species that is commonly utilized in green spaces within subtropical and tropical climate zones. The precise origins of St. Augustinegrass are uncertain; nonetheless, it is recognized as a native species of turfgrass in North America. Over time, it has proliferated significantly along the coastlines of Central and South America, Australia, and the Pacific region (Chen, 1992). St. Augustinegrass is commonly utilized in residential and public gardens across the United States due to its notable capacity for shade tolerance, comparatively lower maintenance requirements in comparison to other warm-season turfgrass species, rapid soil coverage facilitated by its stolons, and resilience against salinity (Reynolds et al., 2009).

Bermudagrass is a species that exhibits strong adaptability to the Mediterranean and Aegean coastal regions of Türkiye, making it a highly favored choice. This preference stems from its



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rapid establishment capabilities and its capacity to withstand heavy traffic. Nevertheless, due to its limited ability to tolerate shade and its need for a minimum of 6-8 hours of direct sunlight to achieve optimal development and growth (Sever Mutlu et al., 2011), greenkeepers are compelled to seek alternate turfgrass species suitable for shaded regions. In this regard, St. Augustinegrass emerges as a significant alternative turfgrass species suitable for places with partial shade and shade conditions, characterized by low levels of foot activity. Although St. Augustinegrass has significant promise for shaded places, it remains relatively unfamiliar in Türkiye. Two significant factors contributing to the restricted adoption of it in Türkiye are its incapacity to establish through seed and its coarse leaf texture. Seed production poses challenges due to genetic factors. Due to this circumstance, it is unfeasible to generate novel St. Augustinegrass cultivars with suitable turf attributes by the conventional hybridization approach. Hence, the utilization of mutation breeding appears to be a significant technique in the cultivation of novel St. Augustinegrass cultivars (Çakır, 2016).

Mutations are characterized as heritable alterations in the DNA sequence due to modifications in the physical and chemical composition of the genetic material (van Harten, 1998). Both physical and chemical mutagens offer effective methods for the development of novel varieties. Mutation breeding enables the generation of genetic diversity in a more expedited manner compared to traditional breeding techniques, facilitating the identification and selection of plants possessing desirable traits from this pool of variation (Taş, 1999). Mutations can arise through natural processes or be induced through intentional means. In recent years, researchers have employed nuclear techniques as mutagens and utilized radiation to induce genetic diversity in seeds and different plant components. This approach enables the identification of acceptable plant selections from among the pool of mutant candidates (Demir & Turgut, 1999). Mutation breeding studies involve the use of ionizing radiation, such as UV rays, X and gamma rays, alpha and beta particles, protons, and neutrons, to induce mutations. The utilization of gamma radiation is extensively favored in the context of physical mutagenesis applications due to its ease of use, capacity to effectively reach target cells owing to its high permeability, and absence of any toxic or detrimental consequences (Schum, 2003).

Mutation breeding has been used successfully in turfgrasses (Tan et al., 2009). It is recommended to use the gamma irradiation approach in the development of new varieties of vegetatively grown turfgrass species (Powell et al., 1974). Many researchers have applied irradiation to turfgrasses and received positive results. For example, the 'Coastcross II' Bermudagrass variety, which produces a denser and higher-quality turfgrass cover, was obtained from the 'Coastcross I' variety to which 70 Gy dose gamma rays were applied (Li, 2007). Among the Bermudagrass species, 'Tif Eagle' (Hanna & Elsner, 1999), 'Tift 94' (Hanna et al., 1997), and 'Tifway II' (Burton, 1985), which are widely used on golf courses, were obtained by gamma irradiation. Dwarfism has been identified as the prevailing mutant trait arising through mutation breeding, as documented by Powell et al. (1974). Nevertheless, researchers have successfully cultivated cultivars that exhibit enhanced seed yield, improved grass quality, a more intense green hue, improved resistance to heat, drought, and fungal infections, as well as an earlier onset of spring regrowth.

The objective of this study is to assess the impact of gamma radiation on the chlorophyll content and color of two distinct clonal genotypes of St. Augustine.



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2. MATERIALS and METHODS

This research was carried out between February 2014 and November 2015 at Akdeniz University Faculty of Agriculture Research and Application Greenhouses. Gamma-ray applications were carried out at Akdeniz University, Faculty of Science, Department of Physics Laboratory. Two different clonal genotypes of St. Augustinegrass, showing coarse ('G') and very coarse ('M') texture, were irradiated at doses of 0, 50, 100, 150, and 300 Gy and 0, 20, 40, 80, and 120 Gy provided by the ^{60}Co source, respectively. Rooting of stolons in viols, selection of promising genotypes, growing of these genotypes, and morphological measurements on the plants were carried out in the greenhouse environment. Details regarding plant materials and method of development of mutant lines used in our previous study (Çakır et al., 2017). A total of 15 mutant lines with dwarf growth habit and finer leaf texture used in this study. Selected mutant lines and their non-irradiated control plants were propagated clonally. The stolons collected from the selected plants were cut into single-node cuttings and planted in plastic pots, each pot containing 15 stolons. The study was conducted in a randomized block trial design with three replications. Stolons were watered regularly to prevent water stress. Starting from the 2nd week after planting, the plants were periodically fertilized once a week with 18-18-18 (N-P-K) compound fertilizer at a rate of 2.5 grams of N per m².

Measurements were made to determine the variation in turfgrass color and chlorophyll contents 12 weeks after planting. Color values were determined with the Minolta Chroma Meter CR 400, Osaka, Japan. The color measurements were conducted on the leaves of five shoots that were randomly chosen within each pot. The Chlorophyll values were collected with a handheld chlorophyll meter (Field Scout CM 1000 Chlorophyll Meter; Spectrum Technologies, Inc., Plainfield, IL), measuring the reflected red and far-red light ratios to calculate the relative chlorophyll content at 80 cm height above the plot surface. The output is a unitless index of chlorophyll content on a scale of 0 to 999. The chlorophyll value of each pot was averaged from 15 readings per pot.

Treatment differences were tested using ANOVA procedures with PROC GLM (SAS Institute, 1999). Means were separated using Tukey's studentized range (HSD) test ($P < 0.05$) procedure.

3. FINDINGS and DISCUSSION

Color, a significant component of the aesthetic quality of turf and the genetic manifestation of turfgrasses, is a crucial selection criterion used by turfgrass breeders in the development of new cultivars. The response of turfgrass pigmentation to treatments may be used as an indicator of treatment efficacy or turfgrass injury potential (Berndt, 2023). The results for the color of turfgrass are presented in Table 1. Although not statistically significant, a*, b*, and C values changed in both directions for both genotypes. Only genotype G showed a statistically significant change in L* value compared to controls. G80-1 and G20-1 had the lowest and greatest L* values respectively. Powell et al. (1974) exposed dormant rhizomes of Bermudagrass 'Tifdwarf' to 68 Gy, 90 Gy, and 113 Gy of gamma radiation and obtained 71 mutant lines. According to them, the most distinguishing morphological characteristics of these mutant lines were color-tone variations and dwarfism. In addition, they indicated that hue values of color mutations were shifted in both directions, and comparable to our study, some of the mutants had light green and light yellow hues. Powell & Toler (1980) administered 45 Gy, 58 Gy, and 70 Gy of gamma radiation to the dormant stolons of the St. Augustine 'Floritam' plant. They obtained 14 lines of mutants. The resulting Mutant-1 line exhibited pink-colored



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foliage. It has been reported that since the 'Floratam' genotype is a hybrid between a line with pink leaves and a line with non-pink leaves, this change may be a spontaneous variation.

Table 1. The effects of gamma ray applications on color of St. Augustinegrass

Genotypes	Lines	L*	a*	b*	C
Genotype 'M'	M-Control	40.82 ^{A1}	-14.50 ^A	19.89 ^A	24.42 ^A
	M50-1	41.77 ^A	-14.81 ^A	21.20 ^A	25.86 ^A
	M100-1	44.06 ^A	-15.54 ^A	21.86 ^A	26.83 ^A
	M100-2	42.02 ^A	-15.30 ^A	22.50 ^A	27.22 ^A
	M100-3	43.15 ^A	-14.98 ^A	21.37 ^A	26.10 ^A
Genotype 'G'	G-Control	40.42 ^{abc2}	-15.23 ^a	22.00 ^a	26.76 ^a
	G20-1	36.76 ^d	-14.56 ^a	21.22 ^a	25.74 ^a
	G20-2	38.50 ^{bcd}	-16.32 ^a	25.67 ^a	30.42 ^a
	G40-1	38.10 ^{cd}	-14.87 ^a	22.42 ^a	26.91 ^a
	G40-2	41.99 ^{ab}	-15.10 ^a	23.42 ^a	27.87 ^a
	G40-3	39.88 ^{abcd}	-14.42 ^a	20.84 ^a	25.34 ^a
	G40-4	39.64 ^{abcd}	-14.98 ^a	22.60 ^a	27.45 ^a
	G40-5	39.52 ^{abcd}	-14.77 ^a	21.12 ^a	25.78 ^a
	G40-6	38.12 ^{cd}	-15.84 ^a	24.54 ^a	29.22 ^a
	G80-1	42.19 ^a	-16.08 ^a	24.24 ^a	29.46 ^a
	G80-2	39.07 ^{abcd}	-15.57 ^a	23.15 ^a	27.91 ^a
	G120-1	38.68 ^{abcd}	-14.70 ^a	21.60 ^a	26.14 ^a

¹Lettering was done by testing each genotype separately. Capital letters indicate the comparison of the averages given for the 'M' genotype, and lowercase letters indicate the comparison of the data for the 'G' genotype.

²According to the LSD test, different means at the 5% significance level are shown with the same letters.

Table 2 presents the results for the chlorophyll content of the mutant lines. There was no statistically significant difference between the chlorophyll content of the 'M' genotype's control plants and mutant lines (Table 2). In the 'G' genotype, the chlorophyll content of G20-2, G40-6, and G120-1 mutant lines decreased by 17–20% relative to the control plants, whereas the chlorophyll content of the other mutant lines did not differ statistically from the control. This study's findings are inconsistent with those of Sever Mutlu et al. (2015). Sever Mutlu et al. (2015) irradiated the tetraploid 'B-165' genotype of bermudagrass at doses of 70, 90, and 110 Gy and obtained four mutant lines. They reported that the mutant lines contained 19% more



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chlorophyll than the control plant. Fehr (1987) reported that the sensitivity of various plant species and genotypes within the same species to any mutagen may vary. Busey (1980) investigated the effects of gamma-ray dosages on seven distinct St. Augustinegrass genotypes and varieties. The author obtained a total of 22 mutant lines that exhibited chlorophyll deficiency. The findings of our investigation correspond with those of Busey (1980).

Table 2. The effects of gamma ray applications on chlorophyll content of St. Augustinegrass

Genotypes	Lines	Chlorophyll content	Difference according to control	Difference according to control (%)
Genotype 'M'	M-Kontrol	264.37 ^{A1}	-	-
	M50-1	250.20 ^A	-14.17	-5
	M100-1	240.50 ^A	-23.87	-9
	M100-2	259.50 ^A	-4.87	-2
	M100-3	248.57 ^A	-15.80	-6
Genotype 'G'	G-Kontrol	281.57 ^{a2}	-	-
	G20-1	251.70 ^{ab}	-29.87	-11
	G20-2	233.50 ^b	-48.07	-17
	G40-1	264.80 ^{ab}	-16.77	-6
	G40-2	265.50 ^{ab}	-16.07	-6
	G40-3	252.60 ^{ab}	-28.97	-10
	G40-4	277.30 ^a	-4.27	-2
	G40-5	277.03 ^a	-4.54	-2
	G40-6	226.07 ^b	-55.50	-20
	G80-1	239.50 ^{ab}	-42.07	-15
	G80-2	249.17 ^{ab}	-32.40	-12
	G120-1	226.37 ^b	-55.20	-20

¹Lettering was done by testing each genotype separately. Capital letters indicate the comparison of the averages given for the 'M' genotype, and lowercase letters indicate the comparison of the data for the 'G' genotype.

²According to the LSD test, different means at the 5% significance level are shown with the same letters.



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4. CONCLUSION

A darker green color and a higher chlorophyll content are desirable characteristics of turfgrass. The level of green color variation within mutants was lower than that reported for other turfgrass species and horticultural commodities. Gamma-ray applications, which help to develop flowers of different colors/tones in horticultural crops, did not positively affect the chlorophyll contents of St. Augustinegrass genotypes evaluated within the scope of this study. Additional research using a broader range of mutant lines is necessary to ascertain whether alternative genotypes/cultivars of St. Augustinegrass provide mutant variants exhibiting more favorable coloration and elevated chlorophyll levels in response to gamma radiation.

Acknowledgments and Information Note

The present study originates from the master's thesis titled "Improvement of Turfgrass Quality by Gamma Ray Irradiation in *Stenotaphrum Secundatum* (Walt.) Kuntze," which was conducted by the first author under the guidance of the second author at the Department of Landscape Architecture, Institute of Natural and Applied Sciences, Akdeniz University. This project was funded by the Akdeniz University Scientific Research Projects Coordination Unit under the project code FYL-2015-543.

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**AN INNOVATIVE AND SUSTAINABLE PRACTICE IN URBAN GREEN SPACES:
EDIBLE LANDSCAPE PRACTICES**

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ABSTRACT

The population and urbanization rate, which continues to increase rapidly in the world and in Türkiye, also brings about destructions in green areas and agricultural areas. The expansion of cities towards fertile lands leads to reductions in agricultural areas, thus causing problems in food supply, meeting basic needs, breaking the human-nature bond and negatively affecting the quality of life of the citizens. This situation forces the world to produce innovative understanding and policies that integrate agriculture into cities. Edible landscaping is an innovative and sustainable landscape design approach that increases human-nature interaction, provides convenience in safe food supply, and has advantages in many economic, social and environmental issues. With the acceleration of urbanization, settlements with high agricultural potential may face losing this potential over time. Thus, both increasing the agricultural potential and providing easy access to food increase the popularity of edible landscapes day by day. These arrangements made with plants that are edible and do not contain any toxic substances are not much different from the traditional landscape made with ornamental plants in terms of maintenance and design. However, providing access to organic, fresh and healthy food and providing educational and instructive social areas for unity, togetherness, sharing and raising awareness make edible arrangements more attractive and advantageous. In this study, the definition and purpose of edible landscape arrangements, their advantages, disadvantages, design and maintenance have been revealed and examples of edible landscape applications in the world and in Türkiye have been examined.

Keywords: Urban Agriculture, Edible Landscape, Sustainability, Urban Food Supply.

1. INTRODUCTION

Nowadays, with the development of industry and technology, the migration of people from rural to urban areas increases the density in cities and also brings with it many problems. According to United Nations Population Fund (UNFPA) data, the world population, which was approximately 7.9 billion in 2021, is expected to exceed 8 billion by 2025 and 9.5 billion by 2050 (URL-1). It is also known that as of 2021, 56% of the world's population and 93% of Turkey's population live in cities. It is estimated that this rate will increase to 68% in the world and 98% in Turkey by 2050 (URL-11). With these population densities exceeding the capacities of cities, the need for accommodation, food and beverage, commercial, social and public areas and transportation axes between these areas increases day by day. In order to meet all these



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needs, existing residential areas have gradually expanded into green areas and agricultural areas, which causes serious damage in these areas. The need for safe food increases with the increasing population and decreasing agricultural areas; this situation threatens soil and water resources. Migrations that start from rural to urban areas with the idea of increasing people's welfare level, over time, bring about unplanned urbanization, thus lands used for purposes other than intended, destroyed forests and agricultural areas, degraded landscapes and habitat areas. These negativities have initially ignored due to the attractive opportunities offered by development; later, they have started to become a problem that made it difficult to meet basic needs. (Demirci,2018; Meral & Doğan,2020).

Human beings are creatures that try to establish a bond with nature and keep this bond strong as a result of their physical and spiritual needs. Today, the rapid increase in urbanization and the destruction of parks, gardens and green areas cause people to stay away from nature (Demiroğlu,2023). Therefore, there is a need to create alternative solution areas to increase the presence of green areas in the city, which have many sociocultural, economic and environmental benefits, and to make arrangements that integrate the activities carried out in rural areas into cities at a more minimal scale and increase human-nature interaction. These arrangements appear in different applications, including roof and terrace gardens, urban agricultural areas and agroparks, eco farms, hobby gardens, permaculture areas, and edible landscaping. (Demirci,2018; Meral & Doğan,2020; Kapan & Öztoprak,2020).

Edible landscaping arrangements, which have a significant contribution to the establishment of urban agricultural areas and constitute the subject of this study, are decorative landscaping arrangements that increase people's awareness of learning and protecting nature, contribute to the supply of safe food, and can be a socializing and active area. While edible landscaping enables aesthetic and decorative images to be achieved by choosing suitable plants, they also offer the opportunity to benefit from the medicinal and aromatic fruits or leaves of the plants used. The purpose of edible landscaping is to produce and consume food, help people socialize, and also provide decorative spaces. Day by day, efforts to grow plants that can be consumed as food are gaining momentum in parks, roadsides, roofs, terraces and vertical gardens, public spaces and campus areas, in short, wherever communities spend time during the day (Meral & Doğan,2020).

In this study, first of all, information about the definition and purpose of edible landscaping, as well as their advantages, disadvantages, design and maintenance will be given. Then, edible landscaping examples in the world and in Türkiye were discussed and suggestions on the subject were developed.

2. WHAT IS EDIBLE LANDSCAPE?

Edible plants are productive plants with fruits or leaves that can be safely consumed by humans without toxic effects. Edible landscaping arrangements are arrangements that take into account the aesthetic and decorative properties of these food-producing plants. These plants, which are used for aesthetic and consumption purposes, generally do not aim to make commercial profit. While the aim is to contribute to the food demand of the increasing population in the most economical way, it is also to encourage local product consumption, to create social areas where people can have a good time, to increase people's awareness of nature and production by including children, especially children, in the production stages, and to obtain aesthetic, decorative and sustainable landscapes. Edible landscaping is a progressive and innovative food



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systems approach that encourages and supports all people to consume local food, whether in private or community spaces and workplaces (Thompson and Sokolowski, 2016).

Edible landscaping uses food-producing plants. These plants, which are used for both their food and decorative properties, can be trees, shrubs, shrubs or herbaceous plants (Meral & Doğan,2020; Demiroğlu,2023). Fruit and nut trees, vegetables, medicinal plants with medicinal-aromatic properties, and ornamental plants with edible flowers and leaves are brought together in these arrangements to obtain aesthetically pleasing images. The location and design of these gardens or the types of plants to be used may vary depending on the purpose of use (medicinal-aromatic garden, fruit garden, etc.) or user density (home garden, city park, etc.). This situation is entirely at the discretion of the designer. Edible landscapes offer an alternative to ornate traditional landscapes established for purely aesthetic purposes. They stand out as an efficient landscaping alternative by integrating food-producing plants into ornamental plants and traditional designs (Kourik, 2004). Simply put, edible landscapes replace decorative plants with plants that both decorate the environment and produce food. They can create attractive and aesthetic images with their colorful fruits or flowers and scented or textured leaves in edible landscapes as well as in traditional landscapes designed with exotic ornamental plants. In recent years, the fact that the maintenance, fertilization and irrigation costs of edible plants are almost the same compared to ornamental plants has increased the popularity of edible landscapes and they have begun to be preferred more frequently in new regulations. In fact, we can say that these investments are more advantageous than traditional landscapes made with ornamental plants, as they provide returns on investments with the supply of fruits and vegetables. There are countless edible plants that can be grown in our country. These plants can be easily included in landscape designs in a locally appropriate way, instead of exotic plants used in traditional landscaping. Thus, it also contributes to obtaining sustainable landscape areas (Fetouh, 2018; Falla et al., 2020)

In fact, the concept of edible landscape is not a new concept. Since ancient times, people have taken care to use edible plants in gardens for different purposes. If we examine the gardens of different civilizations from history to the present, the gardens of Ancient Iran appear as the first gardens where edible plants were used together with ornamental plants. It is also possible to find edible ornamental plants in ancient Egyptian temples (Fetouh,2018). Edible fruit trees and medicinal plants were frequently found in medieval monastery gardens (Beck and Quigley, 2001). Aromatic plants were also used as spices in ancient Greek and Roman civilizations (Melillo, 1994; Cichewicz et al., 2004; Nowicka et al., 2019). The Hanging Gardens of Babylon are also one of the first examples in history of both edible landscaping, roof terrace gardens and vertical gardens (Meral et al., 2018). The purpose of using edible plants in the gardens of the Renaissance period was to meet the need for food and to create a place where one can have a pleasant time with various aromatic fruits. In addition, these fruits were harvested and sold to the public, and the expenses of the palace were covered with the income obtained. It is known that vegetables were frequently used in Renaissance gardens (Wilhelmi, 2013; Çelik, 2017).

The concept of edible landscape was introduced to the literature in the 1980s by Robert Kourik, a landscape designer and environmentalist. It started with the idea that aesthetic designs could also be achieved with these plants in gardens where crops were grown. In 1982, Rosalin Creasy clearly expressed the concept of edible landscape for the first time with her article titled 'The Complete Book of Edible' and introduced it to the landscape world. (URL-2). Edible



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landscaping arrangements are becoming a part of the public day by day and cause changes in the plant species used in landscape design (Creasy, 2010).



Figure 1. Edible Landscaping Examples (URL-3)

3. ADVANTAGES AND DISADVANTAGES OF EDIBLE LANDSCAPE

3.1. Advantages of Edible Landscaping

Edible landscapes are landscaping arrangements that involve aesthetic concerns while growing crops in order to facilitate access to safe food and provide social spaces for people, despite the negativities brought about by rapid population growth and urbanization in recent years. These regulations, which are just beginning to become widespread today, provide people with many advantages in economic, environmental and socio-cultural terms. These advantages can be summarized as follows.

3.1.1. Economic advantages

One of the negative consequences of the population growth brought about by rapid industrialization and urbanization is undoubtedly the growth of cities towards green areas and agricultural areas and the damage to agricultural lands. Decreasing agricultural areas compared to the increasing population makes it more difficult for people to access safe food day by day. Edible landscapes are a solution to these problems and enable people to easily obtain the food they need in daily life. People who access edible plants in their home gardens, city parks and workplaces can save the energy they spend on transportation. In addition, the energy spent on delivering food to people is also saved. Thus, people's ability to access vegetables and fruits whenever they want will also reduce current food costs. Edible landscapes established on small scales show the same efficiency as traditional landscapes established with ornamental plants. Edible landscapes planned on large scales provide more suitable environments for activities such as pollination and fertilization among plants, thus increasing the quality and quantity of products. Thus, the food yield obtained per unit area will also increase. (Meral & Doğan, 2020). Studies show that almost 25% of a city's food needs can be met if the resources used for garden maintenance costs in public gardens, city parks and home gardens are used for edible landscaping. With edible landscaping, extra costs and energy spent for food production, consumption and transportation in cities are reduced and more food is obtained. (Halweil, 2002; Beck & Quinley, 2003; Fetouh, 2018).

3.1.2. Environmental advantages

In addition to facilitating access to fresh and safe food, edible landscaping enables the healthy continuity of water, soil and wildlife and increases biodiversity (Fetouh, 2018). Using edible ornamental plants in landscaping in urban areas saves energy in the maintenance, harvesting, transportation, packaging and waste management of these plants. (Bohn and Viljoen, 2005).



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This situation directly affects both the environment and the economy. Thus, by reducing the use of fossil fuels, it also contributes to the reduction of greenhouse gas emissions that cause climate changes. In addition, it is possible to mention the many benefits of edible arrangements for the environment, such as contributing to the reduction of the urban heat island effect, retaining rainwater flowing into surface flow, and providing functionality and revitalization to empty and idle areas in the city. (Robinson ve ark., 2017).

The use of chemical pesticides and hormones is also increasing in order to meet the increasing food demand and increase the yield obtained per unit area in agriculture. Landscaping arrangements containing edible plants prevent water and soil from being exposed to these chemical-containing pesticides, while facilitating access to natural and healthy food by reducing hormone use. Green spaces with sweet and aromatic plants serve as habitats for insects and birds. Attracting some bird species that feed on insects to the area with edible arrangements will reduce pesticide use. With these regulations, people will be directly involved in the growing periods of plants and will turn to food obtained in more organic and reliable ways. (Henderson, 1987).

3.1.3. Social advantages

In addition to providing people with areas where they can socialize, edible landscaping creates areas that increase human-nature interaction and strengthen the bond within society. Human beings are creatures that tend to be in touch with nature due to their physical and spiritual needs. Well-planned landscaping arrangements allow people, who today have to live disconnected from nature among high-rise buildings, to increase their interaction with nature. Edible landscaping increases and facilitates this interaction, as they are landscapes that offer activities such as growing and harvesting plants. Edible landscaping in a neighborhood park increases the opportunity for collaboration and socialization among neighbors and families during plant care and harvesting. (Holmer and Drescher, 2009). In addition, these interactions of people with nature will increase awareness of ecology and environmental protection. It helps both to provide a solution to the problem of malnutrition and to obtain economic profit from the harvested crops, especially in places with low-income communities. Regulations consisting of edible plants have the potential to meet the raw material needs of industries such as beekeeping, textile, cosmetics and spices. Since it helps to obtain and consume organic products, it also has a significant impact on protecting social health. (Lovell and Taylor, 2013).

3.2. Disadvantages of Edible Landscaping

While renewable landscaping arrangements bring advantageous solutions to many problems, they can also have disadvantages when the right application and maintenance are not provided in the right place. There are many factors that trigger environmental pollution in urban areas where human activities are intense.

These can be listed as exhaust gases resulting from heavy traffic and vehicle use, dirty, toxic greenhouse gases released from industrial sites and causing climate changes, and heavy metals that do not decompose in nature or require a very long time to decompose. These elements directly threaten the plants used in the edible landscape and indirectly threaten human health. In the master's thesis prepared by Batır (2019), the heavy metal concentrations in the organs used as food of fire thistle, linden, apple, rose, walnut, oleaster, cherry and sour cherry species grown in the city center of Eskişehir were compared with the heavy metal concentrations in



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other organs. Within the scope of the study, the concentrations of Sodium (Na), Aluminum (Al), Barium (Ba), Cobalt (Co), Cadmium (Cd) and Lead (Pb) elements in the leaves, branches and fruit organs of these plants are determined and their negative effects on human health are mentioned. As a result of the study, significant changes were observed in the fruits exposed to the elements subject to the study. One of the most important results of the study is that the highest Co, Cd and Pb concentrations were obtained in fruits. These heavy metals are among the most important and dangerous heavy metals for human health.

According to these results, it is thought that edible landscaping applications may cause serious health problems. Authorities should always raise public awareness about not consuming fruits found in areas exposed to these pollutions. In addition, edible landscaping applications should not be used in flood areas or areas where the natural quality must be preserved. (Angotti, 2015). Conflicts between foragers are likely to arise during the harvest period in edible landscape areas. This is one of the disadvantages of regulations. This situation can be solved by regulating and keeping under control the limited collection. (McLain et al., 2014). Failure to choose locally appropriate plant species and varieties in edible arrangements can turn into a disadvantageous situation as it will require excessive care and damage biodiversity. In addition, not cleaning ripe fruits that cannot be collected during the harvest period in these areas and rotten fruits that have broken off from their branches will attract pests. If pest control is not achieved, these areas may turn into areas with bad smells and appearance that are unfit for human use. (Meral & Doğan, 2020; Demiroğlu, 2023). However, despite all these disadvantages, when edible landscape areas are planned and designed correctly, they are ecological and sustainable arrangements whose advantages outweigh their disadvantages.

4. DESIGN CRITERIA FOR EDIBLE LANDSCAPE AREAS

Edible landscaping is the practical integration of food plants into a decorative environment. Edible plants can be combined with another edible plant or ornamental plants in well-planned designs. The biggest challenge in edible landscapes is to create designs that allow urban residents to provide food by imitating natural life without harming the natural environment. (Fetouth, 2018). These designs are realized by using vegetables and bushes with edible fruits instead of plants without edible parts. Many people like the idea of including functional plants (edibles and wild plants) in their ornamental plants. But in reality, it is not always easy to achieve an acceptable aesthetic without careful design and attention to plant selection and each plant's growth habit and needs. (Sousa, 2016). Edible landscapes should offer decorative images as well as useful areas where the user can easily access food. Additionally, it is not necessary to use entirely edible plants in edible landscapes. The rate of use of edible plants should be adjusted depending on the intended use of the designed area and the user density.

Because producing more food than necessary may cause excessive maintenance costs and also lead to waste. Instead, delicious, practical and visually pleasing spaces should be created with the reasonable use of fruits, plants and vegetables. (Creasy, 2010).

Essentially, edible landscaping is designed using the same design criteria as traditional landscaping. However, edible plants should be used together, paying attention to their growth habits and needs. For example, an ornamental plant that is resistant to arid climates and requires low maintenance and a fruit tree that requires regular watering, pruning or fertilization should not be used in the same arrangement. This situation harms the healthy development of both plants and is valid for all edible or ornamental plants to be used in the design. Parks, streets



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with low traffic density, roadsides, and home gardens are suitable areas for edible landscaping. Depending on the wishes of the users living here, arrangements can be made using one or more types of edible plants. The conditions that will make these arrangements successful can be listed as follows: using plants that are reliable and require less maintenance, using plants that look visually attractive and grow faster, using plants that people cannot easily access in the markets, choosing the right plant combinations, establishing irrigation systems suitable for the plant, and preferring smaller areas. (Hensen, 2016). In addition to all these, it is also of great importance to avoid regulations that would endanger the continuity of wildlife, to leave the necessary spaces to facilitate healthy development and maintenance for plants, and to pay attention to plant diversity to ensure the continuity of edible food throughout the year. Considering the characteristics of the selected plants such as form, texture, size and color, using them in harmony in the designs and taking into account the color, smell, aroma and taste of the fruits make edible landscape areas much more attractive. Edible herbaceous plants generally have a short lifespan. Therefore, arrangements made together with evergreen perennial plants provide edible landscapes that grow continuously throughout the year without losing their visual effect (Demirci, 2018; Demiroğlu, 2023).

5. MAINTENANCE IN EDIBLE LANDSCAPING

Arrangements where edible plants and ornamental plants are placed together may bring some opportunities and challenges. In practice, the design criteria used in arrangements with edible or ornamental plants are the same, but there may be a few details that edible plants are sensitive to. Both ornamental and edible plants need care. But xeric ornamental plants, which require less care, are also frequently used in landscapes today. However, in order to obtain yield from edible plants, it requires extra care in matters such as irrigation, fertilization, pruning and pest management. Edible landscapes require maintenance at regular intervals. Unfortunately, if these maintenance processes are not carried out regularly and continuously in a system, these advantages can turn into disadvantages. Therefore, individuals, institutions or organizations responsible for edible landscape areas should place these maintenance processes in a regular system and ensure their controls carefully. These maintenance costs can be minimized by placing the right plant combinations in the right places. For this, plant materials suitable for the local area should be selected, and the wishes and needs of the plants should be taken into account. Not applying the same amount of chemical pesticides or fertilizers to each plant is an important issue in edible landscapes. Before applying the chemicals to be used, their suitability for edible plants should be checked. Edible plants generally require more watering than ornamental plants. Therefore, the irrigation needs of the plants used in the arrangements are an important factor in the designs. Using the hydrozonation method, plants with the same water needs are used together. Thus, the plant is exposed to neither less nor more water than it needs. Edible plants may need pruning to increase crop productivity. Persons or organizations that undertake the maintenance and control of the area should carefully apply the pruning process at appropriate periods throughout the year in order to obtain a productive area for the product and ensure its continuity. (Meral & Doğan, 2020).

6. EDIBLE LANDSCAPE DESIGN EXAMPLES FROM THE WORLD AND TÜRKİYE

In this section, some edible landscape design examples in the United States of America (USA), Cuba, Dubai Emirate, England, Hong Kong and Türkiye are mentioned.



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Edible Landscaping in the USA: The first examples of edible landscaping in the USA began to be implemented during the economic crisis between 1875 and 1917. During these periods, people tried to be least affected by the crisis by obtaining significant amounts of product through their voluntary participation in the maintenance of urban agricultural areas. Although almost 80% of the US population lives in cities, the fact that 40 million hectares of urban area is covered with grass indicates that edible landscaping practices are needed here and these grass areas are considered an opportunity for edible landscaping. (Beck, 2001). Protecting 40 million acres of land with grass and turning these areas into edible landscapes for the more than 54 million Americans who maintain these lawns every weekend is important for the development of urban-scale agriculture. While edible landscaping in these areas is made in the form of traditional vegetable gardens in some designs, in others it is made with ornamental plants by integrating annual vegetables into the general landscape (Demirci, 2018). (Figure 2)



Figure 2. Edible Landscape Design Examples in the USA (Demirci, 2018)

Dubai Urban Agriculture Park: The world's longest urban agriculture park in Dubai is designed to transform the city's longest road into an eco-valley. In the project that re-planned the Sheikh Zayed Road, which is the busiest and longest road in the city, the 25 km long road, which divides the city into two and covers an area of 350 hectares, was underground and transformed into first-class urban agricultural land. This project enabled the establishment of public spaces in order to direct social capital development, provide economic value and support sustainable growth. The park consists of air-conditioned indoor spaces, 80% efficient urban agriculture farms as well as open-air palm plantations. It was planned with the aim of reducing the environmental footprint by reducing the cost and energy consumption of transportation and storage of food grown in the city center. Apart from being an urban agricultural area, it has been designed as an environmentally, economically and socially sustainable park by choosing a vegetative design suitable for the existing vegetation and encouraging the use of local materials. (URL-4). (Figure 3)



Figure 3. Dubai Urban Agriculture Park (URL-4)

Cuba/Havana Urban Agricultural Areas: After the 1959 revolution in Cuba, agricultural development policies were initiated to prevent intensive mechanized and tillage agriculture. As a result of these policies, Cuba, whose population was 10 million in the 1980s, was able to



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produce enough food for approximately 40 million people. However, in 1990, problems in trade and the slowdown in food production caused an economic crisis, and as a result, agriculture began to be practiced in urban areas. In the early 1990s, with the pressure brought by the historical and economic situation, the state began to see urban areas as an important source of food production. Over time, efforts have been made to meet the food needs of the urban population to a large extent. In this process, families living in the city began to cultivate not only in their own gardens, but also in the gardens of their workplaces and in urban open and idle areas. In the 2000s and later, the Cuban Government applied edible regulation methods at three different land scales in order to find local solutions to the food supply problem in the city of Havana. The first of these is the arrangement made by planting edible plants in potted gardens created by filling containers with fertile soil in asphalt or stone-paved infertile areas. The second way was to arrange idle areas in the city with edible plants. The third way was for people to cultivate their own home gardens with edible plants. Intensive gardens, which involve the use of intensive gardening methods to grow the maximum amount of produce on small-scale land, are another edible landscaping method applied in urban areas. In this method, various edible plants are planted in plant beds placed in a tightly arranged arrangement on large areas of land that are not separated by walls or fences. (Keskin & Yildirim,2019). While all these practices are carried out by the state or different institutions/organizations, local governments also allocate land for the use of private individuals. (Koont, 2004).(Figure 4)



Figure 4. Cuban Edible Landscapes and Urban Farming Areas (URL-5)

Edible Landscaping in England: Britain, which has the largest agricultural production potential in the European Union (EU), left the EU with a decision taken in 2016, which led to some uncertainties in the agricultural sector. The UK, which receives more than half of its total agricultural income from aid within the scope of the EU's Common Agricultural Policy (CAP), increased the incentives for local agricultural products in this period in order to avoid difficulties as a result of the termination of these aid. For this purpose, with a program first initiated in the city of Leeds, gardens with fruit trees such as apples and almonds were established in urban areas under the name of 'Public orchards'. Fruit trees were planted in green areas with voluntary public participation, thus aiming to increase beekeeping activities. In addition, while existing agricultural production facilities were protected, farms were established in urban areas and public access to fresh food was facilitated. These urban farms also provide great benefits in education and public awareness. (URL-6). (Figure 5)



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Figure 5. UK Urban Farming Areas And Edible Landscape Designs (URL-7)

Hong Kong Urban Farm Design: Nowadays, the idea of farming in urban areas is widely seen in Hong Kong, especially in order to alleviate the urban heat island effect. Urban farm areas, established by prioritizing locality and sustainability, are planned as common areas that offer different activities where city residents can share their experiences and relax. The areas that allow for increased human-nature interaction also appear as arrangements where edible plants are used predominantly to encourage the continuity of agricultural activities. (URL-8). (Figure 6)



Figure 6. Hong Kong Edible Landscape Arrangements (URL-8 & URL-9)

Edible Landscaping Examples from Turkey (Istanbul Yedikule, Roma and Kuzguncuk Orchards): The increasing rate of urbanization in Turkey after the 1950s caused agricultural lands to be occupied and agricultural lands to be pushed out of the city. While horizontal urbanization started towards existing agricultural areas, agricultural areas were opened to settlement and some of the forests were tried to be converted into agricultural areas (Kapan & Öztoprak, 2020). Over time, Istanbul has been affected by the negative effects of rapid urbanization and has turned into a city where green areas are destroyed, ignoring ecological sustainability. Edible landscape areas have begun to have an important place in order to improve the decreasing quality of life in the city and to increase and strengthen people's connection with nature, which has been interrupted. The first place that comes to mind in our country regarding agricultural and edible landscape areas in urban areas is undoubtedly Istanbul Yedikule Orchards. These gardens, which date back to the Byzantine and Ottoman times, were established to meet the fresh food needs of the Topkapı Palace and the public. According to the information obtained from old written sources, it is known that there were 54 orchards in the region from Yenikapı to Topkapı, and according to a guarantor book prepared in 1735, there were 344 orchards and 1381 workers working in these orchards. (Shopov & Han, 2013). As a result of infrastructure and superstructure works during the Republic period, some of these gardens were damaged and could not be protected. Istanbul Orchards, which still exist today, continue as a strip parallel to the city walls between Bayrampaşa valley, Langa, Yedikule and Topkapı, all the way to Davutpaşa. (Kuban, 1996). Although these orchards still exist, they are planted by people called gardeners and contribute to the food supply of the district where they



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are located. Today, the gardens, which are maintained voluntarily by neighborhood residents and local governments, also instill people's awareness of collective living and offer activity areas where they can socialize. Garden areas, where the calmness of working with the soil and the interaction with nature increase, are frequented by many people and are used as areas for residents to have access to fresh and organic food and to have a pleasant time. The food produced here is shared with the neighborhood residents as well as the immigrant cuisine. Thus, it provides an environment for increasing cooperation and solidarity and sharing experiences. Although different agricultural techniques are used in each garden, there are also differences in the products each garden specializes in. (Karpuz,2015). (Figure 7)



Figure 7. Istanbul Kuzguncuk and Roma Orchards Edible Landscape Arrangements (Karpuz,2015)

In recent years in Türkiye, arrangements where edible plants are grown in urban areas have begun to be seen frequently in hobby gardens established with the support of local governments. Hobby gardens are gardens that offer individual areas where edible plants are planted and harvested for the purpose of increasing interaction with nature and having a pleasant time. These gardens, organized using edible fruits, vegetables and medicinal-aromatic plants, can be shown as examples of edible landscaping areas in cities. The rate of urbanization is quite high in Türkiye, and hobby gardens have become widespread, supported by institutions such as municipalities and universities, as a solution to the negative effects of rapid urbanization. (Figure 8)



Figure 8. Hobby Gardens in Istanbul, Kayseri and Konya (URL-10)

7. CONCLUSION and RECOMMENDATIONS

Edible landscaping are arrangements that offer practical solutions to the negativities brought by urbanization. These regulations are made to improve the quality of urban life, to facilitate access to safe and healthy food, to create areas that allow people to socialize by drawing attention to the awareness of living as a society, and to help ensure the sustainability of natural resources.

With edible landscaping arrangements, people can witness the growth and harvest periods of plants as agriculture is carried out in urban areas, and they can also consume these organic foods, in which they are involved in the cultivation stages, more safely. Although edible



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landscapes have many advantages in economic, social and environmental terms, they can also have disadvantages in some cases.

Productive landscapes that allow people to be involved in these production stages that produce edible healthy foods can turn into useless and disadvantageous areas unless proper care and control are provided. Therefore, maintenance and checks should be carried out by a person, institution or organization in a regular and meticulous system. Edible landscapes, where correct plant selection and correct irrigation, fertilization and pest management are provided, are always more efficient and advantageous compared to traditional landscapes. To increase these advantages, edible landscaping should be areas designed with a sustainable approach.

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URBAN SUSTAINABILITY INDICATORS AND OPEN-GREEN SPACES

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ABSTRACT

Sustainability is a key concept used in many fields today. The concept, which takes its place in the urban planning literature, offers solutions against the negative effects of urbanization and rapid industrialization on societies and the environment. In order to ensure the development of cities in line with the principles of sustainability, it is extremely important to have indicators that will help the development goals to be monitored and evaluated. Today, there are 23 urban sustainability indicators put forward by different countries and organizations in the international arena. The most of these are "United Nations Guide to Urban Indicators" and "European Foundation Urban Sustainability Indicator". In this study, the criteria in these two basic indicators are discussed and the contributions of urban open-green areas to the urban sustainability targets of the relevant criteria are examined on the basis of "ecological", "economic" and "socio-cultural" headings. The findings revealed that urban open-green spaces are one of the main actor of sustainability.

Keywords: Sustainability, Urban Sustainability, Urban Sustainability Indicators, Urban Open-Green Spaces.

1. INTRODUCTION

The main challenge facing today's cities is to reduce the heavy dependence on ecosystem services that lead to the depletion of natural resources and biodiversity. It is also to manage climate change mitigation and adaptation efforts by prioritizing public health and quality of life (EC, 2015). At this point, integrating the concept of sustainability into urban planning and management has become very important, especially in recent years (EC, 2015).

The concept of sustainability emerged in the early 1970s as a reaction to the fact that modern development practices of the period began to cause social and environmental crises around the world. It was used for the first time in 1972 by Donella Meadows and her colleagues in the book "The Limits to Growth". By modeling global population, resource consumption, and pollution trends, they predicted humanity's collapse in the mid-21st century. They emphasized that a sustainable future is possible by changing the growth trend and ensuring ecological and economic balance conditions. (Meadows et al., 1972). The concept, together with the concept of development, was first defined in the 1987 report of the World Commission on Environment and Development (Our common future report - Brundtland Report) as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." (BM,



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1987). Although there are many different definitions of the concept of sustainable development today, varying according to different themes, the necessity of a holistic approach to ecological, economic and social-cultural issues is emphasized in all definitions. (Yıldırım & Akkaya, 2020). In the following periods, the concept became a subject of research in many fields and began to be used. One of these areas is urban planning.

The concept of urban sustainability has emerged as a discourse that can positively affect the quality of life of individuals as a result of the uncontrolled and uncontrolled growth of urbanization, which greatly affects the livability and quality of life in urban areas (Çolakoğlu, 2019). According to Kennedy et al. (2007), *“a sustainable city can only be one for which the inflow of material and energy resources, and the disposal of wastes, do not exceed the capacity of the city’s surrounding environment. In other words, for achieving environmental sustainability urban consumption must match or be below what the natural environment — such as forests, soil and oceans — can provide, and the resulting pollutants must not overwhelm the environment’s ability to provide resources to humans and other members of the ecosystem”*. (EC; 2015). This concept, which requires solutions at a global level, aims to protect and develop environmental resources, as well as to build social solidarity in a society, increase economic empowerment and opportunities, and develop environmental awareness. (Çolakoğlu, 2019).

Urban sustainability has economic, social, cultural and political dimensions. Because the city covers all these dimensions. Activities carried out in cities affect many important elements and require the development of different strategies. It is extremely important to determine the strategies in question according to the scope of planning and the problems and possibilities of the area to be planned, and to look at all these problems and opportunities in an integrated manner, from the planning scale to the design components (EC, 2015; Tuğaç, 2018; Demiroğlu, 2021). At this point, sustainability indicators are very important to create sustainable urban spaces. These indicators measure and evaluate policies, infrastructure, socio-economic factors, resource use, emissions and other processes that contribute to and benefit from the city's metabolism, well-being and quality of life. Urban sustainability indicators are tools that allow urban planners, city managers and policymakers to measure the socio-economic and environmental impacts of urbanization. It also allows cities to monitor the success and impact of sustainability interventions, for example on existing urban designs, infrastructures, policies, waste disposal systems, pollution and citizens' access to services (EC, 2015). Indicators that help governments and communities address sustainability goals provide data to guide policy-making and enable comparisons between local governments and regions (SCI, 2012). Shaping the city within a set of criteria and indicators has benefits not only in ensuring sustainability, but also in developing different ideas for city planners, local governments and decision makers, and in evaluating the suitability of currently carried out actions (Tuğaç, 2018).

There are many important international studies, starting with the 1933 Treaty of Athens and continuing with the 2016 Habitat III conference, that played a role in bringing urban sustainability indicators to the point they have reached today. Other studies include; UN United Nations (UN) Conference on the Human Environment (1972); UN Environment and Development Commission Our Common Future Report (1987); European Urban Charter (1992); UN Conference on Environment and Development (Rio Conference) and Agenda 21 (1992); Habitat II Conference-Istanbul Declaration (1996); Millennium Development Goals (2010); Sustainable Development Agenda and Sustainable Development Goals (2015). It would be appropriate to say that the first steps towards determining the indicators were taken with



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Agenda 21, which was adopted after the 1992 UN Conference on Environment and Development. One of the main objectives of this document is to develop indicators to define sustainable development processes, measure and monitor their performance. The first concrete step towards the development of urban sustainability indicators was taken when Voula Mega proposed the first set of indicators in the Aalborg Charter, which was adopted at the end of the "*First European Sustainable Cities and Towns Conference*" held in Aalborg, Denmark. It is stated in the Charter that urban sustainability indicators are an important guide in achieving social justice, sustainable economy and environmental sustainability in accordance with the carrying capacity of nature and the living conditions of individuals. Cities that have signed the Charter have also committed to engage in Local Agenda 21 processes and develop long-term action plans for sustainability. 4 years after the signing of the charter, the first sustainability indicator that can be used for medium-sized cities was developed under the leadership of Mega and Petersen under the roof of the "*European Foundation for the Improvement of Living and Working Conditions*". (Mega ve Petersen, 1998; Tuğaç, 2018; Çolakoğlu, 2019; EEA, 2023).

Since 1998, many indicators, most of which are of European origin, have been developed by various institutions and organizations at international and regional levels. These indicators can be classified as global level, EU level, those developed by international organizations, country-specific and other. Today, there are a total of 23 indicators developed by different internationally recognized institutions and organizations on a global, regional and national scale. It seems that all these indicator systems that have been defined are aimed at identifying the problems of life in urban areas, developing policies in line with these problems, implementing these policies and monitoring the implementation. (Table 1).



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Table 1. Internationally recognized urban sustainability indicators (Developed from Tuğaç, 2018; Çolakoğlu, 2019; Özkaya and Demiroğlu, 2023 and EU, 2015).

INDICATOR NAME	INDICATOR NAME
<i>Developed at Global Level</i>	
Urban Indicators Guidelines	United Nations
Eco2 Cities Initiative	World Bank
<i>Developed at the European Union Level</i>	
EEA Urban Metabolism Framework	European Environment Agency
European Union Eco City Tool	European Union
European Green City Tool	European Union
European Green Leaf Award	European Union
European Green Capital Award	European Commission
<i>Developed by International Institutes and Associations</i>	
Global City Indicators Program	Global City Indicators Facility
City Blueprint	Waternet Amsterdam: KWR Water Cycle Research Institute
Indicators for Sustainability	Sustainable Cities International
Reference Framework for Sustainable Cities/RFSC	RFSC
Urban Audit Cities Statistics	Eurostat
Urban Ecosystem Europe – Informed Cities	International Council for Local Environmental Initiatives/ICLEI: Ambiente Italia
Urban Sustainability Indicators	European Foundation for the Improvement of Living and Working Conditions
Eurostat Sustainable Development Indicators	Eurostat
<i>Developed for Countries</i>	
China Urban Sustainability Index	Urban China Initiative
STAR Community Rating System*	Sustainability Tools for Assessing and Rating Communities/STAR)-USA
BREEAM Communities*	Building Research Establishment Environmental Assessment Methodology/BREEAM)-England
LEED- Cities and Communities*	United States Green Building Council (USGBC)-USA
DGNB Certification System*	Deutsche Gesellschaft für Nachhaltiges Bauen e.V./DGNB
Greenstar Communities*	Green Building Council of Australia (GBCA)
CASBEE for cities*	Institute of Building Environment and Energy Conservation (IBEC)-Japan
<i>Other</i>	
European Green City Index	Economist Intelligence Unit: Siemens
The Arcadis Sustainable Cities Index	ARCADIS-ABD



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**These are certification systems where sustainability criteria for settlements and communities are defined.*

Although some elements may differ in the indicators, basically all indicators show that "importance is given to the evaluation of natural resources in the conservation-use balance, climate and topography information is taken into account in planning and design, and strategies to reduce greenhouse gas emissions that cause climate change are developed." (Tuğaç, 2018). It is also noteworthy that in almost all indicators, "the presence of open green spaces " and "accessibility to these areas" are among the basic criteria.

The starting point of this study is the contribution of open green spaces, which are the main components of cities, to urban sustainability. Open green spaces are an important component of the city and a critical issue of urban planning. The spaces have a multifunctional contribution. These contributions can be grouped into three basic groups: contributions to urban ecology, economy and socio-cultural structure. These multiple contributions are detailed below.

Contributions to urban ecology: They ensure the preservation of the bond between urban landscape and natural landscape. They prevent habitat fragmentation. They contribute to the protection of urban biodiversity. During photosynthesis and respiration, plants absorb heavy metals and carbon from the air, include them in the process, and decompose them, making them more harmless. Thus, they help improve air quality. They also further decompose harmful substances in the soil with their roots. Thus, they are important in preventing soil pollution. They are important in preventing heat island. They provide thermal comfort in cities. They also create air corridors, affect the moisture balance in the air with their vital processes, and improve the urban microclimate. Roof gardens, vertical gardens and vegetal designs around buildings reduce building energy loss and support energy efficiency. They provide rainwater control. Thus, they ensure the nutrition of groundwater. These processes affect the hydrological cycle. They are also important in preventing disasters such as floods and floods as they increase groundwater permeability. They contribute to preventing erosion and sediment flow. They prevent noise pollution (Gül ve Küçük, 2001; Fam, et al., 2008; Georgi and Dimitriou, 2010; Lovell, 2010; Jorgensen and Gobster, 2010; Ignatieva, et l., 2011; Pincetl, S. and Gearin, E. 2013; Kabisch, 2015; Nero, et al., 2017; Rakhshandehroo, 2017; Demiroğlu et al., 2016; Demiroğlu et al. 2017; Chen, et al., 2019).

Contributions to the urban economy: Open green spaces provide many different economic contributions, from providing a source of income to reducing energy costs. In this context, the areas primarily contribute to increasing housing and land values. They reduce the energy consumption and costs of buildings. They reduce building-energy consumption with roof gardens and vertical gardens. They reduce infrastructure costs by providing natural and sustainable solutions. They increase the interception and infiltration of rainwater, reduce the risk of storm sewer overflows and floods, and minimize the disaster expenses of local governments. They contribute to employment by creating resources for tourism activities. It nourishes edible landscape areas and urban agricultural areas. They reduce public health costs. They support the use of environmentally friendly means of transportation. (such as scooter, bicycle use area). They help the natural decomposition of waste (Curran, 2001; Gül ve Küçük, 2001; Jim and Chen, 2006; Fam, et al., 2008; Philips, 2013; Zoest and Hopman, 2014; Cilliers, 2015, Karadağ, 2018; Donghyun and Seul-Ki, 2019; Ali, et al. 202; Fei et al., 2023).



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Contributions to urban socio-cultural structure: Socio-cultural contributions are contributions extending from the individual to the health and structure of society. The existence of the open-green spaces positively affects people's physical, psychological, mental and sociological health. In this context, its effects on attention deficit and obesity are very important. It is important in children's development. It is also important in increasing the health and social connection of older people. It affects social health by increasing social interaction. It is important for ensuring and improving social equality. By providing recreation services, it ensures quality use of free time. It reduces the crime rate. It offers a field of education and science. It improves the quality of life. It contributes to the continuity of cultural values by providing public venues for activities such as concerts and festivals. It provides a safe emergency meeting and shelter area in times of disasters and crises such as epidemics and earthquakes (Fam, et al., 2008; Jorgensen and Gobster, 2010; Lee and Maheswaran, 2011; Pincetland Gearin, 2013; Jennings, et al., 2017; Demiroğlu, et al., 2018; Javadi, et al. 2021; Lopez, et al., 2021; Li, et al., 2022).

In this context, the aim of the study is to provide information about urban sustainability indicators put forward by different countries and organizations internationally; and to examine the contributions of urban open green areas, which make significant contributions to the ecological, economic and social-cultural sustainability of cities, in achieving the goals of urban sustainability indicators within the framework of two basic indicators, one developed at the global and the other at the EU level.

2. MATERIALS and METHODS

The main material of the study consists of different sustainable city evaluation indicators in the world, which were developed as a result of the accumulation of international studies on sustainable cities (Table 1). In the study, the contributions of urban open green spaces to achieving urban sustainability indicators were evaluated on the basis of the "*United Nations Urban Indicators Guide*" (UN, 2004) and the "*European Foundation Urban Sustainability Indicators*" (Mega and Petersen, 1998).

Urban Indicators Guide; the guide focuses on quality of life and sustainability. The guide consists of 5 main objectives (Housing, Social Development and Poverty Alleviation, Environmental Management, Economic Development, Governance). (Urban Indicators Guidelines, 2004).

European Foundation Urban Sustainability Indicator; the indicator, created by the "*European Foundation for the Improvement of Living and Working Conditions*" in 1998 was developed to draw a common framework for medium-sized cities based on the commitments in the Aalborg Charter. Almost all topics and scopes that can be evaluated in the context of urban sustainability are included. This system, which consists of a total of 16 main indicator headings, includes nine environmental indicators, six social indicators and one economic indicator. The most important difference of this criteria system is that it includes the "Original Sustainability" category. This means that some sustainability practices are specific to a particular city (Mega and Petersen, 1998).

In the study, the multiple benefits provided by urban open green spaces to the city were evaluated as a contribution point/subject to sustainability. As a result of the evaluation, Table 2 was created within the scope of the literature. Each contribution is given a code in the table and 36 contribution codes were developed under 3 main titles. Then, sustainability indicators



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(on the scale of sub-criteria) were examined on the basis of the contributions provided by open green areas, and "contribution codes" were given to each sub-criteria to be contributed. A (-) is added to the criterion for which no contribution is made (Table 2).

Table 2. Contribution points/topics of open green spaces to urban sustainability

<i>Ecological contributions(The spaces.....)</i>	<i>Code</i>
support biodiversity.	C1
retain and decompose heavy metals in the atmosphere.	C2
capture and decompose carbon in the atmosphere.	C3
decompose waste/pollutants in the soil.	C4
prevent heat island and provide thermal comfort.	C5
improve urban microclimate.	C6
reduce energy usage.	C7
feed ground water.	C8
provide rainwater management.	C9
contribute to the prevention of disasters such as floods.	C10
reduce erosion and sediment flow.	C11
contribute to preventing noise pollution.	C12
<i>Economic contributions (The spaces.....)</i>	<i>Code</i>
increase the housing market.	C13
increase the land market.	C14
reduce energy consumption cost.	C15
provide employment.	C16
reduce infrastructure costs and maintenance.	C17
reduce transportation costs.	C18
support sustainable transportation.	C19
reduce healthcare costs.	C20
reduce recreation expenses.	C21
provide economic contribution by turning into a tourism resource.	C22
support the economy from different aspects, such as edible landscapes and urban agriculture.	C23
reduce the costs of combating and adapting to climate change.	C24
reduce disaster-related expenses.	C25
<i>Socio-cultural contributions (The spaces.....)</i>	<i>Code</i>
positively affect human health.	C26
positively affect child development.	C27



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increase social interaction.	C28
improve social equality.	C29
positively affect public health.	C30
provide recreation services.	C31
reduce the crime rate.	C32
support education and science.	C33
increase the love of nature.	C34
supportcultural sharing.	C35
provide safer living spaces in times of disaster and crisis.	C36

3. FINDINGS

In the "United Nations City Indicators Guide", there are basically 5 targets and a total of 19 sub-targets that feed these targets. It has been concluded that the contribution of open-green spaces to the shelter goal is ecological and economical, the contribution to the goal of social development and poverty alleviation is socio-cultural, and the contribution to the environmental management goal is ecological, economic and socio-cultural. Additionally, when the table is examined, it has been seen that the contribution of the spaces to the economic development target is of economic weight, and to the governance goal is of socio-cultural weight (Table 3).

Table 3. UN Urban Indicators Guide (UN, 2004)

GOALS	Contribution Quality of Open-Green Spaces		
	<i>Ecological</i> (code no)	<i>Economic</i> (code no)	<i>Socio-cultural</i> (code no)
1. SHELTER			
1.1. Supporting the right to adequate housing <i>(Fixed structures, excessive density, right to adequate housing, ratio of house and rental costs to income)</i>	-	-	-
1.2. Ensuring the security of property rights <i>(Property right, construction with official permission, eviction by court decision)</i>	-	-	-
1.3. Equal access to loans (Housing finance)	-	-	-
1.4. Equal access to land (Ratio of land prices to income)	-	13,14	-
1.5. Supporting access to basic services <i>(access to safe water, access to advanced treatment, connectivity to services)</i>	2,4,8,9	-	-



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2. SOCIAL DEVELOPMENT AND FIGHTING POVERTY

2.1. Providing equal opportunities for a safe and healthy life (<i>mortality rate under 5 years of age, murders, violent incidents in the city, HIV incidence</i>)	-	-	28,29,32
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2.2. Supporting social integration and disadvantaged groups (<i>Poor households</i>)	-	16,23	28,29
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2.3. Ensuring gender equality in human settlements (<i>Literacy rate; Women's participation in social life; Education participation rate; Women council members</i>)	-	-	28,29,33
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3. ENVIRONMENTAL MANAGEMENT

3.1. Supporting geographically balanced settlements (<i>Urban population growth; Planned settlements</i>)	1-12	13-25	26-36
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3.2. Effective management of water supply and demand (<i>price of water; water consumption</i>)	2,4,8,9	17,24,25	-
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3.3. Reducing pollution in the city (<i>Wastewater treatment; solid waste storage; regular solid waste collection</i>)	2,3,4,8,9,11	-	-
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3.4. Preventing disasters and rebuilding settlements (<i>Disaster prevention and mitigation tools</i>)	9,10,11,12	24,25	33,36
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3.5. Effective and environmentally friendly transportation systems (<i>Journey time; transportation types</i>)	3	18,19	-
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3.6. Supporting mechanisms in line with the preparation and implementation of Local Agenda 21 (<i>Supporting mechanisms in line with the preparation and implementation of Local Environmental Plans</i>)	1-12	13-25	26-36
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4. ECONOMIC DEVELOPMENT

4.1. Strengthening small and micro-scale enterprises, especially those developed by women (<i>informal workers</i>)	-	15,22,23	-
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4.2. Supporting public-private partnerships and employment opportunities (<i>Urban production; unemployment</i>)	-	15,22,23	-
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5. GOVERNANCE

5.1. Promoting localization and strengthening local governments (<i>Local government revenues; local distribution of responsibility</i>)	-	-	-
5.2. Supporting civic participation (<i>Citizen participation; voter participation; civil organizations</i>)	-	-	28,29,35
5.3. Ensuring transparent, accountable and effective governance in cities, towns and metropolitan cities (<i>Accountability</i>)	-	-	-

It has been concluded that the contribution of open-green spaces to the 16 basic indicators included in the "European Foundation's Urban Sustainability Indicators" is greater in the ecological field, followed by economic and socio-cultural areas, respectively (Table 4).

Table 4. European Foundation's Urban Sustainability Indicator (Mega and Petersen, 1998).

INDICATORS	<i>Contribution Quality of Open-Green Spaces</i>		
	<i>Ecological (Code no)</i>	<i>Economic (Code no)</i>	<i>Socio-cultural (Code no)</i>
1. Global Climate Indicator (GCI) (<i>Emitted total CO₂, CH₄, N₂O and CFCs and halons.</i>)	2,3,5,6	-	-
2. Air Quality Indicator (AQI) (<i>Number of days per year on which alarm levels are exceeded and traffic circulation is stopped.</i>)	2,3,5,6	-	-
3. Acidification Indicator (AI) (<i>SO₂ / hectare, NO₂ / hectare, NH₃ / hectare</i>)	4	-	-
4. Ecosystem Toxication Indicator (ETI) (<i>Emitted quantities of cadmium, polyaromatic hydrocarbons, mercury, dioxin, epoxyethane, fluorides and copper. Emitted radioactive substances</i>)	4	-	-
5. Urban Mobility Indicator (UMI) or Clean Transportation Indicator (<i>Urban Mobility Equation (Umeq) = Travel kilometers made by non-environmentally friendly vehicles (private cars, etc.) / number of urban residents</i>)	-	18,19	-
6. Waste Management Indicator (WMI)	4	-	-



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(Waste disposed of by incineration or in controlled landfills and in uncontrolled landfills; waste reused or recycled)

7. Energy Consumption Indicator (ECI) 5,6,7 15,24 -

(Consumed energy according to the source of production (renewable energy, electricity, petrol, gas-oil, heavy fuel oil, natural gas, carbon and wood).)

8. Water Consumption Indicator 8,9,10 24 -

(Water from recycling and used mainly for maintenance of public and green spaces is to be subtracted.)

9. Nuisance Indicator (DI) 4,12 - 26,30

(It is essential to have a subindicator for the % of the population seriously affected by one of the above factors)

10. Social Justice Indicator (SJI) - - 27,28,29,30,32

(It is also essential to have subindicators for vulnerable groups of population (youth, women, the handicapped and long-term unemployed)

11. Housing Quality Indicator - - -

(The number of homeless in percentage of the inhabitants and of those who might become homeless.)

12. Urban Safety Indicator (USI) - - 28,32,35

(It is essential to have a subindicator for the total percentage of irreversible long-term injuries.)

13. Economic Urban Sustainability Indicator (ESI) - 17,24,25 -

(City revenues (total individual income), environmental expenditures (garbage, sewage, transportation, etc.), pollution expenditures (water, air, soil))

14. Green, Public Space and Heritage Indicator (GPI) - - 31,35

(% of green spaces needing improvement/total surface of green space. % of heritage spaces in need of improvement/total surface of heritage space. % of public spaces (including heritage sites) in need of improvement/total surface of public space.)

15. Citizen Participation Indicator (CPI) - - 28,29,35

(The total % of the population active in local elections and participating in associative life.)



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16. Unique Sustainability Indicator (USI) (Indicator to be defined by each city according to its uniqueness (i.e. unique climatic and local conditions) or the planning of a unique once-in-a-lifetime event.	1-12	13-25	26-36
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4. CONCLUSION ve RECOMMENDATIONS

Today, the basis of many environmental problems is the intense human activities carried out in cities that have lost the balance of protection and use. For this reason, cities constitute the focal point of studies on sustainability. It is seen that urban sustainability indicators have been developed in order to find solutions to many ecological-economic-social-cultural-managerial problems that have emerged in cities that have grown uncontrolled and unrestrained, especially since the 2000s. These indicators are important tools in measuring and evaluating the performance of cities in many areas mentioned above. The most important common criterion in these indicators is the open-green space assets of cities and the accessibility of these assets.

In this study, where the contributions of open green areas to achieving the goals of two basic urban sustainability indicators are interpreted, it is concluded that open green areas contribute to many areas of ecological, economic and social-cultural sustainability of cities. These contributions will be guaranteed by considering open-green areas as components of green infrastructure systems, evaluating these components on the basis of sustainable urban planning, and questioning the integration into other urban plans along with the presence of green infrastructure plans in sustainability indicators. However, it is very difficult to reveal these contributions in a quantitative way. This situation makes it difficult to clearly demonstrate the direct effect of the contributions on the indicators. In addition, in this process, it is extremely important to evaluate the ecological and economic contributions of green areas as well as their social-cultural contributions equally. In this regard, studies on the development of quantitative evaluation methods in the field of landscape economics should be concentrated.

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**QUALITY THE IMPORTANCE OF GREEN INFRASTRUCTURE IN THE
QUALITIES OF CITIES AND URBAN LIFE**

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ABSTRACT

Maintaining urban sustainability has been one of the urban planning and design agendas in recent years. Rapid and unplanned city expansion, which brought losing green spaces caused the necessity of ensuring urban sustainability for human habitability (quality of life). It didn't take long for city planners to understand the significance of equal access to natural resources as well as their protection and management in cities, in line with the idea of sustainable development. In order to increase environmental sustainability and human quality of life, green infrastructure refers to a range of technologies, goods, and applications that make use of natural systems or manufactured systems that resemble natural processes. The primary source of ecosystem services that humanity receives from the biotic environment is green infrastructure. Maintaining and developing the Green infrastructure to optimize the supply of ecosystem services, therefore, requires deliberate planning. Green infrastructures provide lots of economic, environmental, and social benefits in the cities, such as Health-promoting, Reducing the effect of the highest sound level, Providing diversity in spatial arrangement, Providing urban aesthetics, Providing a range of ecosystem services and protecting biodiversity in urban settings, and so on. The aim of this paper is to reveal the unequal distribution of green infrastructure in cities, the impact of the problems in accordance with losing infrastructure in the cities, their importance, and what needs to be done.

Keywords: Urban Design, Urban Planning, Green Infrastructure, Green Cities, Ecological Design

1. INTRODUCTION

According to Grimm et al. (2008), cities both greatly influence and are extremely vulnerable to planetary change. Urban infrastructures that are aging and resource- and energy-intensive are becoming more vulnerable to extreme weather events and other global changes.

Cities throughout the world are subject to a variety of risks that are influenced by variables such as rising urban population and climate change (IPCC, 2008). Climate change and urban development are intimately intertwined. Reducing sensitivity to these changes is the main goal of adaptation to climate change (Shirgir et al., 2019). According to the IPCC (2012), climate change will likely result in an overall rise in temperature, more frequent heat waves and the exacerbated heat island effect, a change in the variability of precipitation regime with an increase in high precipitation and flood events, a decrease in the quantity and quality of water resources, disruptions to agricultural production that put food security at risk, a loss of biodiversity, and a decline in the aesthetic and recreational value of the landscape. The capacity for self-organization, the capacity to adapt to stress, and the ability of a system to absorb disruptions while retaining the fundamental structure and functional procedures are all examples of resilience (IPCC, 2008). Climate resilience is one dimension of resilience. Climate



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resilience—a sort of urban ecological resilience that encompasses adaptation to and mitigation of the risks and negative effects of climate change has many different dimensions. In this case, urban green infrastructure is helpful in decreasing the effects of climate change in cities and boosting climate resilience. Since the 1970s, cities have been developing with the idea of green infrastructure (GI). The Boston "Emerald Necklace," which was described as a "complex multifunctional environmental design solution" that connected areas by green corridors (Engleback, 2009, p24), was the first example of urban planning and nature conservation/environmental awareness coming together.

Public parks were originally classified as a type of urban infrastructure in 1996 under the heading "infrastructure as a park and green space." According to Bianoci et al. (2018), "Green Infrastructure" (GI) is defined as an ecosystem or network of ecosystems with distinct components, needs, functions, and services, as well as a connected system of green space that preserves the values and functions of natural ecosystems while also benefiting human populations. The European Union saw green infrastructure (GI) as a clever response to the demands of the present. One of the solutions for coping with climate change, as well as for fostering and advancing climate resilience in cities, is urban green infrastructure.

Since the 1970s, cities have been developing with the idea of green infrastructure (GI). The European Union saw green infrastructure (GI) as a clever response to the demands of the present. One of the solutions for coping with climate change, as well as for fostering and advancing climate resilience in cities, is urban green infrastructure. According to Demouzere et al. (2014), GI generally refers to green roofs, permeable green surfaces, green walks and streets, urban forests, public parks, community gardens, and urban wetlands.

Given their tendency to be densely populated and impermeable, cities require as much green infrastructure as feasible. The term "green infrastructure" refers to anything that helps absorb, delay, and treat rainwater in an urban setting to reduce flooding and pollution downstream. This includes everything from parks to street trees and green roofs. Additionally, green infrastructure produces oxygen, absorbs carbon, and supports biodiversity (Hussein et al, 2020).

2. MATERIALS and METHODS

The most important question that may arise here, is Why should green infrastructure get involved in the urban planning and development. What is the problem?. This research contains three steps. The following section offers the research questions and a review of the literature related to the concept of urban green infrastructure. The third section of the paper focuses on the types of urban green infrastructures based on the literature review research. The last section is devoted to a general evaluation and conclusion (Figure 1).

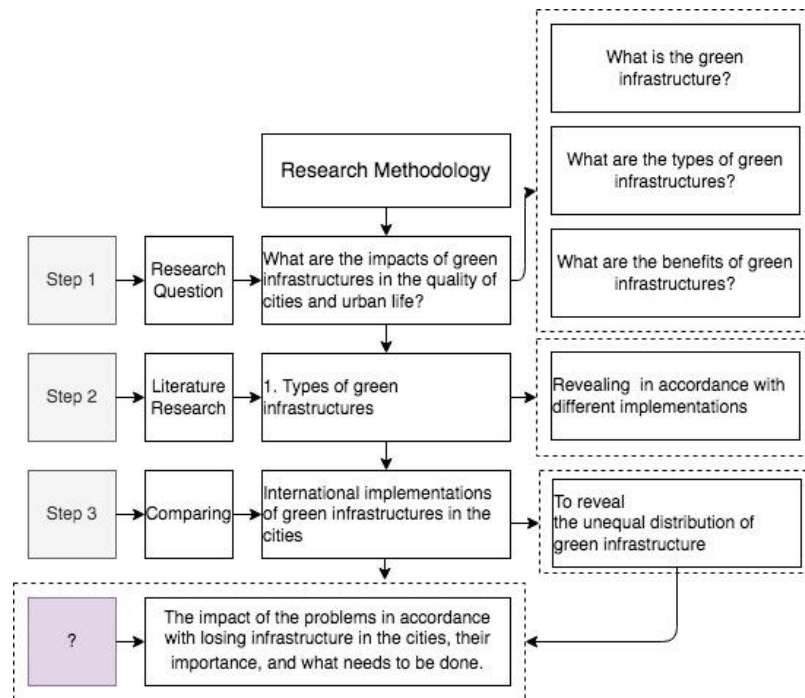


Figure 1. Research Process (by the author).

3. FINDINGS and DISCUSSION

According to The Assian Development Bank (2014) In the nations that have had the least impact on global warming and climate change, low-income and middle-income populations are currently experiencing direct and indirect effects of climate change. Climate change will undoubtedly have the greatest impact on the lower income classes (Asian Development Bank, 2014).

This vulnerability is exacerbated by population pressure. By 2050, two-thirds of the world's population will live in cities, and many countries already have a high urbanization rate. Today's cities are developing toward more resilient, self-sustaining systems to maintain quality of life for expanding urban populations while maintaining within safe planetary biophysical constraints (Röckstrom et al. 2009) (Reynolds et al, 2019).

The quality of life, the state of the economy, and social stability are all negatively impacted by urbanization and climate change. Climate change mostly affects the regions with high concentrations of people, businesses, and infrastructure (green-gray). Due to their physical location, some metropolitan regions are also more susceptible to increased effects of climate change, such as high temperatures, rising sea levels, and fluctuating precipitation. A city's rapid growth will replace greenery with hard construction surfaces, amplifying the consequences of climate change (IPCC, 2008). As a result, precipitation is decreased and temperatures rise. To reduce the adverse effects of climate changes in the cities there is an urgent need to prepare and implement Design Guidelines for climate-responsive urban green infrastructure. Anticipating potential effects of climate change on green infrastructure and modifying management practices accordingly are necessary for proactive planning for climate change.



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According to Klemm (Klemm et al., 2017) the guideline can be prepared in three scales, city, park and Street. At the same time all these parameters should be understanding, applicability, and viability.

4. CONCLUSION and RECOMMENDATIONS

In cities, green infrastructure offers numerous economic, environmental, and social advantages, including; providing urban beauty, improving health, reducing the impact of the loudest noise, providing variety in spatial layout, conserving biodiversity in urban areas and providing a variety of environmental benefits.

Green infrastructures can be implemented in different scales of design in cities, such as green walls, green roofs, and green public spaces, permeable green surfaces, green walks and streets, urban forests, public parks, community gardens, and urban wetlands (Demouzere et al., 2014).

Table 1. The Advantages of Green Infrastructures (Parker and Zingoni de Baro, 2019).

Advantages			
Welbing and Health Advantages	Environmental Advantages	Economic Advantages	Social Advantages
Elevated Mental Mood	Sequestration of carbon	Cheaper in capital costs than alternatives	a stronger sense of community
Elevated Physical Mood	Expansion of biodiversity	Cheaper in terms of operational costs than alternatives	Enhanced amenities
enhanced mental recovery	Better air quality	Reduced energy usage	Decreased crime
A rise in productivity	habitat possibilities		
decrease in stress	Food source		
	Weather adaptation		

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**THE CONCEPT OF A BIODIVERSE-FRIENDLY CITY IN THE FACE OF
CLIMATE CHANGE**

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ABSTRACT

In recent years, the urbanization trend resulting from the population's migration towards urban environments has put pressure on open-green spaces. The inadequacy of open-green spaces due to the increase in physical structures leads to climate changes such as urban heat islands. The climate-related changes in urban ecosystems also affect urban biodiversity. Therefore, the plant species used in open-green areas have become more important to reduce the impact on urban biodiversity from these changes. New landscape design approaches should be sought to address the expected drought problem due to possible climate changes. Using drought-resistant, natural plant species and edible plants in urban spaces can provide economic, ecological, functional, and aesthetic benefits, as well as contribute to urban biodiversity. Climate change will be determined for the year 2050 with the UrbClim software model. According to the result of this, the plant list for the urban space will be determined. While there are many studies on urban biodiversity, there are relatively few studies on biodiverse cities. In a study focused solely on road trees, Liu and Flik (2021) examined the concept of biodiverse cities as a friend to biodiversity. This paper aims to explore the concept of biodiverse cities using natural and edible plant species in urban open-green spaces, such as residential areas, urban transportation corridors, city parks, and urban public gardens. The criteria for biodiverse cities will be established based on these two concepts. The ratios of these drought-resistant and extreme climate-tolerant plant species to other plant species used in urban open-green spaces will be determined and methodologically based on plant species ratios and densities. Areas with a plant species count exceeding the established ratio will be designated as biodiverse cities. Strategies will be proposed to raise awareness and implement this concept at the local, national, and global levels. This paper aims to provide data to the literature and practice as the first study on the criteria for biodiverse cities.

Keywords: Urban Biodiversity, Biodiverse Cities, Natural Edible Plant Species, Drought-Resistant Landscaping.

1. INTRODUCTION

In the UN development report, it is stated that by 2050, nearly 70% of the world's population will start living in urban areas. As a result, urbanization movements resulting from the increasing urban population in the world and in our country have led to a series of challenging environmental issues in urban ecosystems. Especially with the decreasing agricultural areas and green spaces, urban heat island formation threatens urban biodiversity. Due to inadequate attention to natural and ecological thresholds in physical development, cities fail to reap the difficult benefits of natural ecosystems, making them vulnerable to disasters. Climate change has begun to negatively affect urban areas in particular:



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Scientists have indicated that July 2023 could be the hottest month since the industrial revolution, with an absolute global average temperature increase ranging from 1.3 °C to 1.7 °C. It is emphasized that the consequences of inaction against global warming are unacceptable and that carbon emissions need to be reduced urgently, and cities, infrastructure, and healthcare systems need to be redesigned for climate change (URL, 1). According to a press release in July 2023, the U.S. government has decided to allocate 1 billion dollars for tree planting to combat climate change.

According to the Intergovernmental Panel on Climate Change (IPCC), global temperatures have already risen by 1.1°C and are progressing towards 1.5°C. Following the Paris Climate Agreement (COP21) held in 2015 with the participation of 194 countries and the UN Climate Change Conference (COP26) held in Glasgow in 2021, the 27th Parties to the UN Framework Convention on Climate Change was held in Egypt in 2022 with the participation of 190 countries. As a result of this meeting, it was decided to prepare action plans to keep global climate change below 1.5 degrees by the end of the century (URL 2, 2023).

Urban Biodiversity

Urban biodiversity is defined as the diversity of flora and fauna in different habitats within urban ecosystems. According to Müller et al. (2013), urban biodiversity refers to the "diversity or richness and abundance of living organisms (including genetic diversity) and habitats found in the environment and its surroundings. Species vary from rural areas to urban cores. Humans have a long history of transporting plant species and influencing local biodiversity. Survival and reproduction of wildlife species are directly related to the presence of urban landscape areas. Plants and animals in cities interact with the existence of social and ecological systems, often creating unique biotic communities unique to that city.

Various research has revealed that biological diversity within cities is higher than in the surrounding areas. Larger urban landscapes have been found to have more non-native species than smaller urban landscapes (Pyšek et al., 2004).

However, rapid changes in physical structures in cities, the loss of open and green spaces, and climate change are increasingly putting urban biodiversity under more pressure.

Urban ecosystems, being warmer in cold regions, benefit biodiversity with longer plant growth, protected building environments, local irrigation, moisture presence, and conscious or unconscious food availability. Environmental pollution and the destruction of natural habitats threaten urban biodiversity. According to Sukopp and Wurzel (2003), despite ecological and socio-economic factors affecting plant cover in urban areas, many non-native invasive species that colonize (or become naturalized) in cities come from warmer regions and benefit from more favorable climates.

Urban tree species are important components of floristic diversity. In a study, it was emphasized that as the number of tree species increases, ecosystem resilience increases, and a single tree species should not exceed 10-20% of the total tree species (Kendal et al., 2014).

Trees and shrubs planted in various areas in urban spaces are important natural elements that connect people to the biosphere (Liu et al., 2021). Urban plant diversity, consisting of natural/native species, brings many advantages, such as supporting urban greenery sustainability, sensitivity to climate change, supporting wildlife and native fauna, and low maintenance costs.



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The use of fruit-bearing plant material is more common in private gardens (single-family homes, housing, collective housing, some public institution gardens, etc.) in our country (Dikmen and Yılmaz, 2021). Fruit trees in urban environments contribute to visual landscape quality with flower and fruit colors, autumn leaf color changes, and are important building blocks that support wildlife (birds, bees, butterflies, some insect species, etc.) ecologically and economically. In a study (Demir and Aydın, 2020), it was found that in terms of biodiversity, areas with intense human activities have more insect diversity compared to areas with low human activities.

Urban open-green areas are the most important building blocks for regulating climate/heat island formation, reducing its negative effects, and increasing the resilience of cities in the face of increased urbanization (Figure 1). These areas undertake many vital tasks such as ecological, aesthetic, economic, socio-psychological, recreational, and contributing to biodiversity (Yılmaz et al., 2021; Alves et al., 2022; Balany et al., 2022; Quyang et al., 2023; Young et al., 2023).

A New Concept: Bio-Friendly City (BIOCITY)

The use of fruit-bearing plant species in urban environments is a critical criterion for creating bio-friendly cities. The concept of a bio-friendly city was first introduced in a study conducted in China (Liu and Slik, 2021). In this research, street trees in 59 Chinese cities were considered as natural species and fruit-bearing trees, and it was concluded that these plants were not adequately represented in urban areas.

In this study, the concept of a BIOCITY, particularly in the context of urban biodiversity's importance and sustainability in the face of climate change scenarios, aims to provide a resource for biological diversity research.

BIOCITY covers the analysis of open-green areas such as urban spaces, street trees, public institution gardens, residential gardens, urban woodlands, cemeteries, squares, sports fields, and their vicinity. A suggested form has been created for implementation in each area.

In any urban open-green area, the Biyodost settlement criteria recommendation form includes the following analyses:

As Bio-Friendly City criteria recommendations:

The number of natural species used for each land use will be considered, along with the number of fruit-bearing species.

The total number of plant species for each land use.

The ratio of one tree species to the total number of tree species in each land use.

The age of planted vegetation in each land use.

The size of the area.

The ratio of green areas to impermeable surfaces.

Positive ecosystem components.

Negative ecosystem components.



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Each of the above criteria is assigned a score out of 100 based on its contribution to biodiversity according to the specific characteristics of the area. Settlements that score above 60% are defined as Biyodost.



Figure 1. Urban green spaces contribute to urban biodiversity

2. CONCLUSION and RECOMMENDATIONS

To minimize the harms of rapid urbanization, world leaders agreed upon 17 global goals in 2015 under the title of "Sustainable Cities and Communities" by the United Nations. Among these main goals, particularly, sustainable development has brought significant pursuits such as promoting healthy and quality living, accessible and clean energy, sustainable cities and communities, climate action, life below water, and life on land (URL 3).

The invasion of exotic plants into cities, rapid physical changes in urban ecosystems, and resulting environmental pollution, as well as the fragmentation of ecological corridors/habitats with changes in topography, are all leading to a decreasing resilience in urban biodiversity. Urbanization fragments or eliminates natural vegetation, leading to habitat loss and isolation. Altering the spatial arrangement and heterogeneity of landscapes disrupts ecological pathways (Müller et al., 2013; Aznarez et al., 2022).

The rapid urbanization and global biodiversity loss necessitate new research that provides information on policies, management, and protection in urban ecology (Knapp et al., 2021). It is assumed that natural species will provide a broader range of biodiversity benefits (Berthon



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et al., 2021). It is known that urbanization changes local conditions and can make urban living areas unsuitable for native plant species (Sjöman et al., 2016).

With Bio-Friendly City:

The concept of a biodiversity-friendly city in urban landscape approaches against climate change scenarios can be a new approach.

Although the components/criteria of the Bio-Friendly City concept have been determined, the development of applications through this criterion can be achieved through field applications.

Strategies for urban open-green areas to meet the Bio-Friendly City criteria can be determined by decision-makers, subject experts, and public participation in cities.

For other cities in our country, this concept can be popularized by applying it to any urban green area, and by promoting it, it can gain brand value.

In this regard, a study on the concept of a biodiversity-friendly city (Bio-Friendly City) has been conducted for the first time in this work. The fact that no similar study has been conducted in our country or abroad makes this idea or concept unique.

The concept of a Biodiversity-Friendly City (Bio-Friendly City), which will be discussed for the first time through this study and the fact that it will be discussed in the scientific community and public opinion as a brand value for cities in our country and worldwide, is also an important step in terms of developing strategies.

In conclusion, in our present day when we are beginning to experience all the negatives of climate change, there is a need for new approaches for sustainable urban ecosystems. The importance of urban open-green areas for urban health, ecology, aesthetics, economics, and sociology has increased. New concepts like **BIO-FRIENDLY CITY** need to come to the forefront, and different disciplines should come together for their implementation, initiating the first applications to develop this concept.

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A CONCEPTUAL REVIEW ON SECOND HOME TOURISM

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ABSTRACT

Tourists' reasons for traveling create various types of tourism. Houses where individuals spend their leisure time outside their permanent residence in order to have fun, rest and get away from stress are called second homes. The socio-economic events that occur during the temporary stays in second homes have brought prominence to the concept of second home tourism. Unlike other tourists, second home tourists visit the same region to be together with the same people during their stays. Therefore, they are considered as marginal tourists. Second homes are studied from various perspectives in the disciplines of architecture, urban planning, geography, and tourism. The main objective of this study, designed through qualitative research method, is to establish a theoretical framework related to second home tourism. In addition, the sub-objective of the research is to assess the social, economic, and environmental impacts of second home tourism and to develop recommendations based on existing studies. Within this framework, the concepts of second home and second home tourism have been thoroughly explained. Document analysis and literature review have been conducted in line with the defined objectives. According to the findings of the study, second home tourism is mostly studied in geography and tourism disciplines. Studies have shown that while second homes are important for the continuity of economic benefits derived from tourism activities; However, in terms of socio-cultural impacts, they may have negative effects on the local community. Furthermore, it has been determined that in areas where second homes develop without proper planning, they exert pressure on the environment and infrastructure. On the other hand, second homes, which hold a significant place within domestic tourism, have become the most preferred tourism type during the COVID-19 pandemic. As a result of the research, in areas that have not benefited from mass tourism investments but are rich in natural resources, the development of planned second housing tourism and infrastructure works for this purpose are presented as recommendations.

Keywords: Second Home, Second Home Tourism, Literature Review.

1. INTRODUCTION

Tourism activities are essentially composed of temporary and non-commercial trips. Travel undertaken for tourism purposes has various economic, social, cultural, and environmental impacts (İçöz, et al., 2019). Tourists engaging in economic activities by spending money without the intention of earning during their travels hold a significant place in the economies of countries and regions. Tourism income generated from the expenditures made by tourists during tourism activities has positive economic effects, such as contributing positively to the balance of payments, assisting in the reduction of trade deficits, addressing foreign exchange constraints, and creating employment opportunities. Therefore, tourism activities hold a significant place in national policies (Kozak and Bahçe, 2009; Bahar, 2020).



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Tourism activities in Turkey began to develop from the 1950s onwards. The mass tourism movements (sun, sea, and sand tourism) that gained momentum in the 1960s further accelerated by the 1980s in Turkey. Particularly, the Tourism Incentive Law No. 2634, enacted in 1982, supported mass tourism movements. Tourist visits to Turkey have consistently increased over time, except during crisis periods. Recent tourism statistics reveal that, apart from the COVID-19 outbreak in December 2019, Turkey has witnessed an increase in both tourist numbers and tourism revenue (TUIK, 2021). During the COVID-19 pandemic, mass tourism activities came to a halt, and tourists shifted their focus from mass tourism to alternative tourism activities. In this context, there has been an increase in demand for second homes during the COVID-19 period (Zoğal and Emekli, 2020). As a result, during the COVID-19 pandemic, second homes have gained prominence in the revival of tourism activities, and there has been a growing emphasis on second home tourism (Zoğal et al., 2020).

The importance given to second homes has increased in Turkey, leading to the initiation of construction activities for second homes (Emekli, 2004). Starting from the 1980s, Turkey's building capacity began to increase in terms of second homes. As the number of individuals participating in tourism activities increases, there is also a growing interest in second homes (Cohen, 1974; Hilber and Schöni, 2020). In this context, second home tourism holds a significant place within the tourism industry today. Second homes are important not only within the scope of outbound tourism but also within the scope of domestic tourism (Kervankıran and Çuhadar, 2017). A significant portion of overnight stays in Turkey takes place in the homes of relatives, close acquaintances, and second homes (Mutlu and Avcıkurt, 2021). Therefore, the main objective of this study is to establish a theoretical framework for second home tourism. Additionally, the sub-objective of the research is to highlight the social, economic, and environmental impacts of second home tourism through existing studies and to develop recommendations.

2. CONCEPTUAL FRAMEWORK

In this section, the concepts of second homes and second home tourism are elaborately explained. Within this context, information is provided about the development process of second homes, and studies related to second home tourism in the fields of tourism and geography disciplines are examined.

2.1. The Concept of Second Homes

There are numerous definitions in the literature regarding the concept of second homes. According to Clout's (1971) definition, second homes are residential properties or apartment units owned by individuals that are used for short-term stays during specific periods of the year, excluding tourist facilities. According to Clout, the primary purpose of staying in second homes is to fulfill individuals' vacation needs. According to Manisa (2007), second homes are fixed properties built in destinations rich in natural and cultural resources, such as coastal areas, mountains, lakes, and thermal springs, outside of individuals' primary residences. These properties are used for vacation purposes during specific times of the year and are associated with tourism-related real estate investment. The concept of being associated with tourism, as mentioned in this definition, stems from the alignment of second home usage with the principles of leisure in tourism (Hall, 2014). In another definition, second homes are the residences to which individuals travel in order to escape the stress and chaos of daily life in their primary permanent residences (Emekli, 2014). Authors often define the concept of second homes as



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residences located in areas near water sources, different from individuals' primary residences, and used during specific periods of the year to escape from daily life (Oğan and Yasak, 2021). Based on these definitions, we can list the characteristics of second homes as follows:

- Being located in areas rich in natural resources,
- Temporary use for tourism purposes,
- Possessing the characteristics of a fixed property,
- Being considered as real estate investment.

The term "second" used in the concept of second homes does not indicate a sequence. The primary reason for using the term "second" is that these homes remain vacant for a significant part of the year (Emekli, 2014). In other words, the term "second" does not denote a sequence of owned properties but rather refers to a residence used at a specific time, excluding the primary permanent residence (Zoğal and Emekli, 2018). When reviewing the literature, it can be observed that second homes are classified and labeled based on their seasonal characteristics and structural conditions. In English, terms like "summer houses," "second housing," and "second home" are used, while in Turkish, they are referred to as "yazlık evler" (summer houses), "kır evleri" (countryside houses), "çiftlik evleri" (farmhouses), and "rekreasyonel konutlar" (recreational houses) (Müller, 2002; Okuyucu and Somuncu, 2016). Table 1 demonstrates the classification of second homes.

Table 1. Classification of Second Homes

Type	Structure	Building/Vehicle
Permanent	Houses and Apartments	Remote Country Houses and Homes Second Village Houses Apartment Buildings
Semi-Portable	Camps	Vans/Mobile Homes Recreational Vehicles Tents Caravans
Portable	Boats	Sailing Boats

Source: (Hall and Müller, 2004: 5).

As seen in Table 1, second homes can have different types and characteristics. However, the areas where second homes are developed generally exhibit similar features. These regions often include:

- Areas rich in natural resources easily accessible to major urban centers,
- Coastal regions and their vicinity,
- Highlands with tourist attractions (Emekli, 2014).

2.2. Second Home Tourism

Tourism types are formed based on the purpose of travelers' trips. In this context, interactions arising from travels to second homes contribute to the emergence of second home tourism in the visited destinations. These trips to second homes fulfill the conditions included in the definition of tourism (Müller, 1999: 33). Unlike other tourists, individuals participating in



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second home tourism travel to the same destination to spend time with the same people. Therefore, these tourists do not possess the motivation to seek experiences or be in the company of different individuals, as is the case with other tourists (Cohen, 1974). Consequently, second home tourists occupy a position between being locals and tourists (Müller, 1999). In tourism-oriented second home usage, the travel duration between individuals' primary residence and the second home holds significance (Kauppila, 2010). The travel distance between individuals' primary residences and their second homes, where they can spend their weekends, ranging from 100 km to 250-400 km, is significant in terms of the usage of second homes. This is due to the fact that the frequency of second home usage decreases after 200 km (Lipkina, 2013). When the travel distance exceeds 400 km, the rate of second home ownership also declines (Okuyucu and Somuncu, 2015). However, for second home tourism to develop in areas beyond 400 km, these regions need to have more abundant natural resources. Therefore, the development of second homes located by the sea or lakeshores with rich tourism products and those in winter tourism areas is not influenced by the distance factor (Kauppila, 2009). Second homes in Turkey are typically constructed in areas with high tourism appeal in the Aegean and Mediterranean regions. Additionally, there are second homes suitable for weekend usage in locations close to the city center of Istanbul (Gökdeniz, 2014). In this context, second homes are significant for domestic tourism.

Domestic tourism activities encompassing travel for tourism purposes within the political boundaries of a country hold significant importance in many countries around the world for reducing interregional development disparities and promoting balanced development (Turner and Reisinger, 2001). In Turkey, second home tourism plays a pioneering role in invigorating domestic tourism. Due to their seasonal usage, second homes commonly referred to as "yazlık" (summer houses) are prominent in terms of overnight stays in Turkey (Mutlu and Avcıkurt, 2021). In this context, it can be stated that second homes are an indispensable element for domestic tourism (Jackson, 1986).

2.3. Development Process of Second Home Tourism

Second homes have been frequently used for various purposes throughout history. For instance, in ancient times, affluent individuals would satisfy their accommodation needs in their second homes during their travels to different destinations (Gomes et al., 2017). In countries like Sweden, the United Kingdom, and France, cities such as Stockholm, London, and Paris have second homes that affluent individuals have used at various times. In Greece, individuals belonging to the upper class have acquired second homes for tourism purposes.

In its contemporary sense, second home tourism has developed in the vicinity of large cities. After World War II, individuals' prosperity increased, and there was a growing demand for second homes driven by the understanding of tourism (Huang, 2003; Bakırcı, 2007). Additionally, the desire to escape the stressful urban life (Adamiak et al., 2015) and the ability for foreigners to purchase properties in Turkey under the framework of European Union (EU) harmonization laws (Manisa, 2007) have contributed to the popularity of second homes.

In Turkey, following the transition to a free market economy after the 1980s, second homes have been utilized as a means to support development (Emekli, 2014). During this period, advancements in transportation and the widespread use of automobiles accelerated individual tourism movements, leading to an increase in the use of second homes for leisure purposes in tranquil areas near large cities. On the other hand, in the 1990s, haphazardly constructed second



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homes led to issues of unused capacity and exerted pressures on the environment. Subsequently, the 1999 Gölcük earthquake and the 2001 economic crisis reduced the demand for second homes in Turkey. However, after 2003, the legal regulation allowing foreigners to purchase properties under the EU harmonization laws and the reduction of housing interest rates revitalized the demand for second homes (Emekli, 2014; Manisa, 2007).

2.4. Review of the Literature on Second Home Tourism

Second homes have various social, economic, and environmental impacts, which is why they are studied in different disciplines. In this context, studies on second homes and second home tourism are extensively conducted in geography and tourism literature. Studies conducted within the field of geography provide a comprehensive understanding of tourism (Hall and Page, 2012). In this context, it can be said that geography and tourism disciplines share similarities in their scope of study. When examining geographical studies related to second home tourism, it becomes evident that the selection of areas for the development of second homes places significant importance on the geographical characteristics of the region (Emekli, 2014). Therefore, the areas where second homes are situated need to be geographically suitable. Within this scope in a qualitative study investigating the reasons for choosing the Urla district of İzmir as a second home area, findings revealed the attractiveness of the region in terms of natural resources, affordable housing prices, and its proximity to İzmir (Zoğal and Emekli, 2018). The second home owners included in the research evaluated the economic vitality provided by second homes as a positive feature. However, causing spatial clustering and exerting pressure on the environment were considered negative attributes.

In another study conducted by Yasak and Doğan (2018), the reasons for the development of second homes in Silivri were analyzed. As a result of the study, it was revealed that Silivri's location on the main transportation lines and its close location to Istanbul accelerated the development of second homes in Silivri. Tourism activities also develop in the areas where second residences develop. Studies conducted in this context are included in the tourism discipline.

In the tourism discipline, second homes have been addressed in terms of different topics. These topics are generally; evaluation of second homes in tourism (Önder et al., 2010; Manisa and Görgülü, 2008; Kozak and Duman, 2011), perceptions of local people about the development of second home tourism and foreigners' second home acquisitions (Avcıkurt et al., 2021; Karakaya and Turan, 2006; Öztürk et al., 2007; Kadı, 2014; Baltacı, 2011), socio-economic impacts of second homes (Oğan and Yasak, 2021; Marjavaara, 2007; Ünlüönen and Çimen, 2010; Velvin et al., 2013), meanings attributed to second homes after the COVID-19 pandemic and motivations for second home ownership (Clout, 1972; Jackson, 1986; Chaplin, 1999; Lipkina, 2013; Turksoy, 2021). Upon reviewing the literature, it is observed that the conducted studies predominantly employ quantitative methods and utilize survey designs (Avcıkurt et al., 2021; Baltacı, 2011; Oğan and Yasak, 2021; Okuyucu and Somoncu, 2016; Ünlüönen and Çimen, 2010; Öztürk et al., 2007). In these studies, surveys have been used as the data collection method. The scarcity of studies that comprehensively investigate second home tourism from the perspectives of local communities, destinations, and second home owners using qualitative methods is noteworthy (Zoğal and Emekli, 2018). Therefore, there is a need for in-depth studies designed with qualitative methods to be conducted on second home tourism.



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According to the findings of studies in the literature, it is recommended that second homes should be developed not only in coastal areas but also in regions abundant in natural resources. The development of second homes in these areas will foster economic vitality and alleviate unemployment issues in the regions (Önder et al., 2010). Furthermore, the utilization of second homes in tourism will contribute to an increase in the accommodation sector's capacity (Manisa and Görgülü, 2008; Kozak and Duman, 2011).

When examining the results of studies investigating the effects of foreign individuals acquiring second homes, it has been determined that such acquisitions can create multiplier effects on the economy. On the other hand, it has also been found that foreign individuals acquiring second homes can lead to certain socio-cultural drawbacks. These drawbacks include the unintended use of second homes, economic leakage issues, and tax losses (Kadı, 2014). Conversely, foreigners purchasing real estate in Turkey can have a positive impact on the country's image (Öztürk and Bayram, 2021). Consequently, it is suggested that this can lead to an increase in the number of tourists and tourism revenues.

When the participation of individuals in second home tourism and their motivations for acquiring a second home are analyzed; the prominent factors in the acquisition of second homes are escape from stressful city life (Clout, 1972; Chaplin, 1999; Lipkina, 2013) and the need to be in touch with nature (Jackson, 1986). The natural resources, climate and social opportunities of the destination mostly affect individuals' second home preferences (okuyucu and Somoncu, 2016).

The popularity of second homes has increased after the COVID-19 virus emerged in Wuhan, China in December 2019. In this context, studies on the use of second homes during the COVID-19 outbreak are included in the tourism literature. One of these studies was conducted in Çeşme district of Izmir. According to the findings of the study, second home tourism increased significantly in Çeşme during the COVID-19 period. It was determined that this situation caused inflation by increasing housing rents and housing prices. In addition, as a result of the intensive use of second homes, it was determined that the infrastructure was strained and daily life was negatively affected (Türksoy, 2021).

3. RESULT and RECOMMENDATIONS

The proliferation of second homes and the development of second home tourism in Turkey coincided with the enactment of the Tourism Incentive Law in 1982. In this period when mass tourism activities gained momentum, the construction of second homes also accelerated. Initially concentrated in coastal regions, second homes were later built in all regions of Turkey. In this context, the concept of second home tourism emerged. The expenditures made by individuals participating in second home tourism in their second homes provide economic mobility (Marjavaara, 2007). These expenditures revitalize the local economy and create indirect employment (Müller, 1999). Although the development of second home tourism in these regions reduces inter-regional development differences, the use of second homes in certain periods of the year leads to spatial agglomeration by causing the population to increase suddenly. In this context, within the framework of EU harmonization laws, the ability of foreigners to acquire second homes in Turkey has had both positive and negative effects on the economy. This study provides a broad perspective by analyzing the social, economic and environmental impacts of second home tourism. The findings of the literature review and evaluation can be summarized as follows:



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- Second residences are residences that are located outside the permanent residences of individuals participating in tourism activities and are generally used for vacation purposes. The development of these dwellings usually takes place in areas with high natural and touristic attractiveness.
- Second homes play an important role in economic activities and increase tourism revenues. It also has positive effects such as revitalizing the local economy and reducing unemployment.
- Second-home tourism plays an important role in revitalizing domestic tourism and diversifying the tourism sector. The preference of second homes, especially in the immediate vicinity of big cities, for weekend getaways contributes to the revival of domestic tourism.
- Site selection for the development of second homes is a factor where geographical characteristics are of great importance. Factors such as natural resources, transportation facilities and touristic attractiveness play a decisive role in the location of second homes.
- The effects of second home tourism are studied in various disciplines. Geography and tourism have similar fields of study and there is interaction between these two disciplines.
- In the literature, there are studies on second home tourism mostly designed with quantitative methods. There is a need for more studies that will analyze in-depth with qualitative methods.

As a result of the unplanned development of second home tourism activities, agricultural lands are opened to second home construction, coastal areas are crowded, forests are damaged, unplanned construction, regional inflation and other undesirable consequences (Emekli, 2014). In addition, in these areas, migration from rural areas to cities is accelerating due to increased prosperity due to tourism activities. This situation negatively affects agricultural production (Çıkın et al., 2009; Rye, 2011). Therefore, planning should be done carefully in the areas where second home tourism will be developed. Otherwise, the costs and taxes incurred by local people living in these areas will increase. Therefore, although the positive economic effects of tourism activities are also seen in second home tourism, second homes also cause some negative effects. In this context, the demand for second homes slowed down in the 1990s due to reasons such as the contraction in the construction sector, the principle of prioritizing public interest on the coasts, the increase in the number of accommodation establishments and the cheapening of vacationing, and the 1999 earthquake (Somuncu et al., 2010). However, with the enactment of the law allowing foreigners to acquire property, the demand for second home tourism has started to rise again.

Housing sales to foreigners stimulate both tourism and the construction sector. Both of these sectors employ a large number of people with high multiplier effects. Therefore, they have a positive impact on the economy. The literature emphasizes that second home tourists spend more than other tourists (Okuyucu and Somuncu, 2015). This situation reveals the importance of second home tourism. In order to maximize the benefits of second home tourism, attention should be paid to tourism planning and infrastructure investments in areas where second home tourism is developed (Adamiak et al., 2015; Dal and Baysan, 2007; Müller and Hoogendoorn, 2013).



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In future researchs, studies can be conducted on the development of planned second home tourism in regions that have not received the required share of tourism investments but are rich in natural resources. In this context, it may be recommended to conduct more qualitative studies in the field of second home tourism and to examine this issue from different perspectives. In addition, more research needs to be conducted on the environmental impacts and sustainability of second homes. These studies can contribute to a better understanding and management of second home tourism. In addition, the effects of second home tourism on local communities in areas where second home tourism has developed can be investigated. These regions could be Istanbul, Ankara, Antalya, Mersin and Antalya, which have the highest number of second home sales to foreigners in Turkey. In addition, the reasons why foreigners acquire second homes in these regions can be inferred from the opinions of second home owners and recommendations can be put forward.

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**A SEMIOTIC ANALYSIS OF THE REFLECTION OF GRAPHIC ART ON MEDIA
DESIGNS: POSTERS OF CHIP KIDD**

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ABSTRACT

In the research process, the use of social and visual semiotic strategies to make sense of events and concepts in the fields of media, mass communication and culture enables the development of new methods. In a semiotic sense, the questioning of codes and ideas in terms of facts and meanings points to the intersection between concepts and semantic content. In this sense, semiotics includes everything that can be understood as signs. It can be said that it is an important tool that shows the development of creative expression as well as the development of technology and media. In particular, media reality has brought different perspectives to semiotic research. Considering the compatibility of graphic design with media and technology, it is normal for different indicators to emerge. For this reason, in this research, both the literature on how semiotic analysis is structured and the semiotic analysis of the posters of the American artist Chip Kidd, who attracted attention with his graphic posters and billboards, were made.

Keywords: Indicator, Semiotics, Graphic Design.

1. INTRODUCTION

Meaning clusters have an extremely complex structure, they represent something different from what they describe, they are filled with new meanings just when we think we understand them, they allow different approaches and even interpretations, they deepen by embracing each other, they embrace people more deeply, they gain meaning again with the existing and developing human culture. In this sense, they need to be reorganized and explained. What fulfills such an effort is the so-called semiotics of signification (Şahin, Arat, 229).

Semiotics is an interdisciplinary field of study that questions the formation of meaning. The meaning can be any text, logo, symbol, photo, building or advertisement. Semiotics, which is a rapidly developing branch of science, especially after the 1960s, has started to be used consciously in the fields of art, communication, marketing and advertising. These are the approaches to reading the representation systems of a text through signs, giving meaning to codes, evaluating intertextual relations with verses, syntax, metaphor and metonymy, and examining the ideology and culture underlying hidden meanings. Semiotics, which emerged from linguistics, has become an independent science with the rapid development of new media and communication technologies in recent years, and has become a universal science with its own unique and interesting microcosms, including linguistics. Beyond natural languages and the meaningful universe that surrounds man; beliefs, customs, actions, passions, advertisements, fashion, architecture, television, cinema, literature, theater, painting and photography are some of the systems consisting of signs, and semiotics aims to reconstruct these expression systems by reading, interpreting and analyzing them. Semiotics develops a model that enables people to make sense of the world they live in (Parsa, Olgundeniz, 2014).



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In activities of daily living, real objects or ideas are explained by what individuals perceive and interpret. There are several indications that these objects are covered by the time they are perceived. These metrics may vary depending on the perceived context. The indicators we use for certain purposes in our daily lives and these indicators actually make intuitive-sensory associations (Erişti, 2021).

Astronomy

Semiotics; The terms "semiology" (German) and "semiology" (English) in European languages are based on the ancient Greek word "semeion". The term we call semiotics in Turkish is represented by two different terms in English: "semiotics" and "semiotics". These two terms are synonymous. Both are intended to study signs and meanings. This indicator is for any individual. In other words, it is a matter of creating a status in the mind of the individual that will give him an equal or higher status than himself. A science created by studying the life of indicators in society; This science is social psychology, that is, it will be part of general psychology; this science is called semiotics (Star, Virgo, 2019). The current meaning of the science in question cannot be reduced to the sum of the meanings of the concepts that make up the term Semiotics in Turkish. The merging of two fields of theoretical activity, which correspond to two different terms in Western languages, under a single Turkish term poses such a problem. Semiotics, the first activity to study signs from the perspective of communication, is said to have a realistic approach and approaches language and language skills on a superficial level, as if describing specific, observable physical objects that exist in nature. The second approach, on the other hand, sees language faculties not as a single class object to be observed, but as a whole consisting of constructed and constructed classes of meaning, and tries to reinterpret and understand its basis and formation. In doing so, it is not aimed to become an attitude that is content with describing observable linguistic phenomena, but to create a general theory of linguistic ability and to organize it within a scientific theory (Yasa, 2012).

Semiotics began to become an important approach to cultural research in the late 1960s. Semiotics, based on the work of Roland Barthes, was intended to address in particular any system of signs, regardless of its nature and limitations; pictures, gestures, musical sounds, objects and their complex connotations. Ceremonial, conference, or public entertainment content: they create, if not language, then at least systems of meaning. Saussure's term semiotics is sometimes used to refer to the Saussure tradition, "semiotics", sometimes refers to the Peirce tradition, but today the term semiotics means: the set of signs that includes all kinds of systems within its scope. Semiotics as an academic discipline has not been widely institutionalized. It is a field of study in which many people are involved. It includes different theoretical stances and methodological tools. One of the broadest definitions can be defined as the one made by Umberto Eco, "Semiotics deals with everything that can be taken as a sign" (Chandler, 1994).

Ignoring each other's work, Peirce and Saussure formulated the basic principles of semiotics that underlie modern semiotics. Saussurian semiotics is language-oriented and based on the nature of communication; In the semiotic Peircian approach, the nature of materials is explained in a logical context and from a pragmatic point of view: The main objective is to reveal what we do not know beyond what we know about objects. Modern and post-modern theorists have used the ideas of Peirce and Saussure to understand language and culture. Pondaag explains that semiotics is a science or an analytical method for studying signs. These are the signs that we are trying to find a way between being with people and people in the world. Eco explains



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semiotics as the study of a set of objects, events, and entire culture in the form of signs. These signs are said to represent something else that has been built on the basis of social contracts. Zaini uses semiotics in the science of communication, especially in the analysis of media messages or texts (Sitanggang, 2020). The use of semiotics in the science of communication is based on the assumption that the medium contains a set of signs. Another scholar, Roland Barthes, was perhaps the first social semiotician to use semiotics to understand media culture in his book *Myths*. In his semiotic analysis, he reveals individual or group interests and ideology regarding social behavior from a political/critical point of view (Erişti, 2021).

The French philosopher Roland Barthes is the most influential figure in the world of semiotics. He was a philosopher, literary critic, structuralist, and semiotician. This semiotician developed the work of Ferdinand de Saussure, including structuralism and semiotics in the text. The key in Barthes' semiotic analysis is the concept of content and content. This model, through Barthes, establishes that the importance of the first stage is the relationship with external reality between the signifier (manifestation) and the signified (content) in a sign. Barthes identifies the most obvious meaning of the indicator as the indicator. By the way, the connotation has a subjective or at least intersubjective meaning. In other words, the signifier is what the signifier tells about an object, while the meaning of the connotation is how it is defined (Siragar, 2022).

According to Barthes, images are linked to aesthetic and ideological elements, paving the way to read and interpret inferences to explain how meaning is created through complex semiotic interaction. Thus, semiotics in media studies provides recipients with the information they need to be able to analyze and create meaningful texts and designs in the future. In this context, Barthes argues that the death of the author/creator of the text allows the recipient to witness the birth of the text and create a form of semiotic production of various meanings, interpretation, reading and observation. It is the complexity of semiotic interpretation and the analysis of messages and media discourses in order to open the semiotician's senses to new methods of using signs in social and cultural contexts. In fact, Roland Barthes' approach is widely applied in media studies, which focus on the semiotic analysis of different media areas such as advertising, cinema, film, music video and cartoon. The influence of Barthes' work in recent years has led communication semiotics and epistemology to question the symbolic interaction of linguistic and non-verbal signs. Barthes has made a great contribution to the field of analysis of textual images in order to reveal their meaning, which is based on the functional order of cultures and systems, and therefore their intermediate importance (Bouzida, 2014).

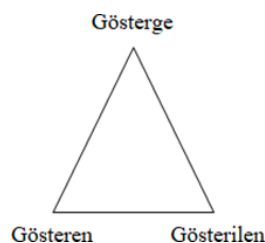


Figure 1. Barthes' Indicator Analysis

Various concepts are widely used in semiotics. Signs include explicit and implicit meanings that people use in their communication with each other or with entities outside of themselves, such as spoken language, body language, signs, symbols, etc. These symbols are difficult to



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understand and analyze because they contain many different forms. Reference, another concept that shapes this science, is the message that the indicator wants to convey. The sign is defined as a symbolic universe that contains all the signs and associations that the interpreter points to and evokes in his mind. Meaning is the meaning that derives from the relationship between what the signifier wants to represent and what is signified. One of the concepts we often encounter in semiotics is terminology. Anything that has a scientific meaning is called a term. The meanings of terms do not change depending on where they are used. In semiotics, Saussure argues that language is a system because the parts that make up a whole are defined as "systems" (Özdemir, 2020).

Semiotics includes everything that can be considered an indicator. A sign is anything that can be considered a substitute for something else. This other thing does not have to continue to exist as the meaning it represents, anywhere at any time. Therefore, semiotics is a disciplined principle that can examine everything that can be used (Erişti, 2021).

Natural language is a system made up of different behaviors, gestures, images, traffic signs, the spatial layout of the city, musical works, paintings, theatrical performances, films, advertising posters, posters, fashion, literary works, different scientific languages that people use to communicate, in short, the order of passions, the structure of the ways of communication within a nation, an architectural arrangement, a system made up of all the different units of meaning, whether they are for communication purposes or not. The units of these systems, which have different implementation plans, are also generally understood as indicators. In this sense, semiotics; Language, code, properties, etc., are a field of structural chain science. Indicators are actions or structures that refer to something other than themselves. The code is the system by which indicators are organized and defines how indicators can be related to each other. Fiske claims that these indicators and codes have been communicated to others or made available to others. According to Fiske, handing over or receiving signs is a fact of social relations (Özgür, 2006).

Indicator	Indicating	Shown
Traps Banner		Portraits consisting of nested boxes depicted on a rectangular composition and colored writing styles were used. In the design, the use of cold and warm colors together is preferred. At the same time, a remarkable composition has been formed by taking into account the descriptive power of the artist.
Time Poster		The poster named Time, designed by Chip Kidd, draws attention with a design consisting of 100 boxes. In the painting, black, white and red colors are generally used and three colors are concentrated.

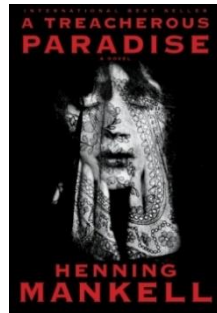


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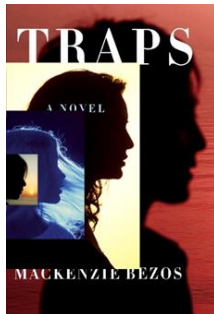
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Paradise Leaderboard



The poster called Paradise is seen among the remarkable designs of the artist. The poster, which is depicted in a rectangular composition, focuses attention on the styles with the sharpness of the red color, intensifying with the harmony of black and white and its tones.

Indicator

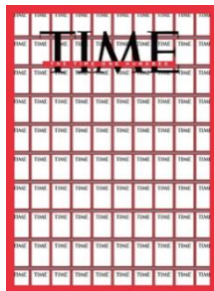


Plain Meaning

The poster consists of nested boxes, and inside each box, there are face faces that attract attention with their perspective feature and color contrasts that provide sharp separation of shapes. Fonts are placed in the upper and lower parts of the poster and integrity is ensured.

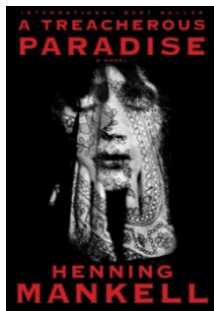
Connotation

Although the poster contains concrete things in its plain meaning at first glance, its inner meanings are moving towards abstraction, and the cross-section of each moment attracts attention. The contrast and balance of the colors used are seen as a difference.



The poster shows the times divided into boxes with the tangible and the sections framed by sharp red lines.

The poster is sharpened with frames in which a face is separated by different times and each time.



In a rectangular composition that appears concretely on the poster, there are red text styles in the upper and lower sections and a face face in the middle of the poster.

In the poster, an effective composition arising from the combination of white and red colors on a black background was tried to be created.

2. CONCLUSION and DISCUSSION

Semiotics is an interdisciplinary field of study that questions the formation of meaning. Its meaning can be any text, logo, symbol, image, building, or advertisement. Semiotics, which is a fully developed science, has started to be used consciously in the fields of art, communication,



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marketing and advertising, especially after the 1960s. These are approaches that aim to read the narrative systems of a text through signifiers, to give meaning to codes, to evaluate the relationships between texts and inscriptions, syntax, metaphor and metonymy, as well as to examine the ideology and culture behind hidden meanings.

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ANALYSIS OF THE MORPHOLOGICAL OF HAMAMYOLU ÇARŞISI

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ABSTRACT

Urban morphology is a field of study that assists in deciphering these changes by examining the physical form and urban structure of settlements as they evolve over time. The Hamamyolu Bazaar, located in the city center of Eskişehir, has undergone various physical changes over time. These changes have had various impacts on the physical and social structure of the city. In this context, the aim is to conduct a morphological study of the Hamamyolu Bazaar. For the urban morphology analysis of the Hamamyolu Bazaar, a geographical-based morphological analysis method developed by Conzen was employed. In this method, the historical development of the Hamamyolu Bazaar was initially examined. During this step, key turning points in the evolution of the Hamamyolu Bazaar were identified and its historical development was investigated. In the second step, analyses regarding land use parcel-building relationships were conducted using the maps obtained for the identified turning points. According to the results of the study, it was determined that the Hamamyolu Bazaar has undergone changes at the building scale over the years, influenced by various factors such as urban planning and zoning regulations. Additionally, it was revealed that the Hamamyolu Bazaar has been a significant area in terms of recreation and commerce since the establishment of the city.

Keywords: Urban Morphology, Hamamyolu Çarşısı, Eskişehir.

1. INTRODUCTION

In the course of historical development, objects such as buildings, streets, and walls located in urban space undergo various transformations due to various reasons (interventions by users, experts, decision-makers, etc.). From this point, it is possible to assert that space undergoes a "change in state" over the course of historical processes through the activities of individuals. This change in state becomes tangible and observable through spatial transformations within the city, revealing different spatial organizational structures in different periods. Cities can exhibit variations in morphological diversity depending on their size and historical background. Therefore, what is crucial in morphological research is the identification of relationships and differences that occur in various periods (Ünlü, 2018).

Urban morphological studies used to identify the relationships and differences in the transformation of the city across various historical processes have been carried out since the beginning of the 20th century and continue to be examined from different perspectives (Cömert, 2015). In its simplest form, urban morphology can be defined as the examination of the physical form and structure of a city (Santa, 2003). Moudon (1997) expresses that urban morphology is used to read and analyze cities based on their physical forms, and it is employed in determining how cities are constructed and transformed. Madanipour (1996) defines urban morphology as a systematic study concerning the constructed structure of cities, the fundamental forms, plans, structures, and functions of buildings, and how they develop over time. In summary, it is



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possible to describe urban morphology as a process of changing forms over time. Researchers focusing on urban morphology investigate the development of the city from its establishment to the transformations that occur over the years, identifying these transformations as breakpoints in the city's history (Bayer, 2020). Researchers have employed various methods for urban morphology analyses. Philippe Panerai, Jean Castex, and Jean-Charles Depaule have developed a research model in their works, such as "Elements of Urban Analysis" and "Principles of Urban Analysis," using approaches like the concept and methods of urban analysis, urban structure, urban morphology, and parcel configurations. Within this research model, they have addressed the analysis of urban landscapes through studies focusing on the visual perception dimension (Cullen-Townscape, Kevin Lynch-Urban Image), incorporating it into the analysis of urban form (Bilsel, 2018). Various methods for urban morphology analysis include spatial configuration, morphological analysis using GIS, the Conzen method, the typological-morphological approach, and the connection of urban morphological analyses with the dynamics of cities' social, economic, and political contexts (Hillier and Hanson, 1984; Conzen, 1960; Bayer, 2020).

Conzen method, which is a part of urban morphology within the field of geography, is the most representative work reflecting the concepts and methodological framework of M.R. Conzen's urban morphology approach. The concept of "historical urban geography" that has developed within the field of urban geography shapes the subject matter of urban geography as human settlements, the emergence of cities, settlement patterns, urban systems, and the subjects of historical, social, and economic processes. It has evolved as a subject of study that encompasses the macroform of cities, spatial and functional organization, urban plans, and the shaping and transformations of urban fabric (Bilsel, 2015).

Conzen further developed the concept of morphology, initially used by Schuler in 1898, and approached the morphological development and analysis of cities within the framework of historical development theory (Cömert and Hoşkara, 2018). According to Conzen, urban plans can be analyzed in accordance with their developmental patterns over different time periods. The fundamental unit of analysis is the parcel. The subdivision of parcels provides a systematic infrastructure for urban form. Conzen recognizes that urban plans are composed of different components, which can be observed in variations in streets, parcels, building sizes, and forms (Gürer, 2016).

Conzen focused his research on reading urban landscapes and identified three main features in his studies: urban plan-ground plan, building texture, and land pattern and building usage (Whitehand, 2001). In his analytical method, which he referred to as "urban plan," Conzen distinguishes the three fundamental elements of urban planning: streets, parcels, and buildings (Gürer, 2016). In the historical-geographical morphogenetic method, urban space is analyzed in conjunction with its context. This analysis, known as urban plan analysis, focuses on examining the changes, transformations, and variations that occur in urban space based on the results of changes in parcel, building, and street patterns obtained from historical maps for specific periods, as well as the land use situation in the area (Sakar and Ünlü, 2019; Conzen, 1960).

Conzen conducted his study in Ludlow using the urban plan analysis method, in which he identified all the distinctive areas of the city. To make these identifications, he utilized parcel-building type, land use status, and urban fabric analyses. According to Conzen, the urban fabric,



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which encompasses not only physical elements but also social experiences, distinctiveness, and historical accumulation, allows for the formation of different development periods and characters over time (Conzen, 1966). Conzen suggests that it is possible to analyze cultural periods and spatial character by analyzing the components of existing conditions, building fabric, and land use. As seen, within the framework of the historical-geographical approach, this study aims to conduct a morphological analysis of Hamamyolu Çarşısı in the context of the changes that have occurred during the historical process.

2. MATERIALS and METHODS

The main material of the study, Hamamyolu Çarşısı, is located in the Odunpazarı region of the city. Within Hamamyolu Çarşısı, you can find traditional bazaars, passages, municipal buildings, residential buildings, hotels, and recreational areas. Hamamyolu Çarşısı serves various functions and is situated in close proximity to the focal points of the city (Figure 1).



Figure 1. The Location of Hamamyolu Çarşısı within the City

Hamamyolu Çarşısı contains traditional bazaars, the municipal building, passages, residential structures, accommodation facilities, recreational areas, and more (Figure 2). Due to its historical significance and its role as the city's first commercial hub, Hamamyolu Çarşısı holds a prominent place in Eskişehir. It is located in the area bounded by İki Eylül Avenue, Deliklitaş Avenue, and the Porsuk River. Within this area, you can find the city's earliest neighborhoods, namely Arifiye and Deliklitaş neighborhoods. Taşbaşı Çarşısı, located within Hamamyolu Çarşısı, has been designated as an urban conservation area. It is a place where the traditional bazaar culture of the city is preserved. Streets within this bazaar are named after the trades they host. For instance, you can find areas like the Clockmakers' or Goldsmiths' Bazaar. Additionally, the study area serves as a natural hot spring center for the city. The region houses natural hot springs that supply hot water to the surrounding baths. Hot springs have been a significant factor for the city from its history to the present day. The hot spring source is within an area with a diameter of 200-225 meters, situated between the Aerial Hospital and Deliklitaş Avenue. The primary source is collected within the courtyard of the Mosque of the Bazaar (Balta, 2005).

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Figure 2. Boundaries of the Study Area

In summary, Hamamyolu Çarşısı has been selected as the primary material for the study due to its significance in tracing urban memory over a vast historical period, its role in maintaining vibrant and continuous public life, and its appeal to a diverse range of users. The study focuses on Hamamyolu Çarşısı, which encompasses various places such as the Sıcak Sular Bölgesi, Taşbaşı Çarşısı, Hamamyolu Caddesi, and Çukur Çarşı. Therefore, there are studies that specifically address Hamamyolu Çarşısı and the spaces within it. Looking at these studies: Aksoylu (1995) collected data on the condition of Taşbaşı Çarşısı before and after expropriation, and provided design recommendations for this historical area. Albek (1991) and Ertin (1994) discussed the historical and physical development of Eskişehir. Alpan (2016) highlighted the role of Hamamyolu Caddesi as a central axis and offered design recommendations to address the issues that emerged in Hamamyolu Caddesi during the 2010s. The study 'Dünden Bugüne Eskişehir'deki 14 İşletmenin Öyküsü,' edited by Kozak (2013), examines the oral history (in-depth interviews) and the historical development of unique flavors in Eskişehir, especially in Hamamyolu Çarşısı. Nalçakan et al. (2015) evaluated changes in Çukur Çarşı within the context of the concept of 'place.' Üstün and Özkan (2016) focused on the spatial transformations of Hamamyolu Caddesi since the Republic Era. Büyüktaş and Kaçar (2023) delved into the impact of the furniture in Hamamyolu Caddesi and other parks within the city on the city's identity. Upon examining these studies, it becomes evident that the absence of a morphological analysis of Hamamyolu Çarşı and its constituent spaces underscores the importance of the study in the existing literature.

Analysis of the Morphological of Hamamyolu Çarşısı

To conduct the morphological analysis of Hamamyolu Çarşısı, the study was carried out in two distinct phases. In the first phase, the historical development of Hamamyolu Çarşısı was



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examined using data obtained from newspaper articles, works in the Eskişehir City Memory Museum, exhibitions, literature, and traveler's observations. This allowed for the identification of critical turning points in the history of Hamamyolu Çarşısı. In the second phase, the morphological analysis of Hamamyolu Çarşısı was performed by comparing maps related to the area, including street layout, block-parcel relationships, and building-parcel relationships. Conzen defines urban morphology as the acquisition of layers of historical periods. With this method, changes and transformations in land use, building fabric, and genetic planning units are analyzed (Cömert, 2015). The Conzen method is grounded in a historical-geographical approach, making it suitable for this study. The maps used in the Conzen analysis were selected to be from years corresponding to the significant turning points in Hamamyolu Çarşısı. Various maps from different years and characteristics, aerial photographs, newspaper photographs, and archive photographs were utilized in the morphological analysis of the study area. The maps used in the study date back to the 13th century, 1891, and 1956.

The historical development of Hamamyolu Çarşısı:

Cities undergo various social, physical, political, and economic processes that shape their forms. Streets, buildings, and other physical components adapt to changes in spatial practices by users and shifts in the cultural geography within the city over time. Therefore, it can be said that historical processes are significant variables that influence the physical forms of cities. Historic city centers, with their accumulated historical layers, are noteworthy areas within cities for their historicity, layering, and urban characters (Sakar and Ünlü, 2019). In this context, in order to assess Hamamyolu Çarşısı morphologically, it is essential to first determine the changes it has undergone during its historical development, how it has evolved, and identify the key turning points throughout its historical timeline. To achieve this, data was collected from local (Milli İrade, Sakarya, İstikbal) and national (Akşam, Cumhuriyet, etc.) newspapers, existing studies in the literature, the Eskişehir City Memory Museum, and the Cultural Heritage Preservation Board. The assessment of Hamamyolu Çarşısı's morphological changes and historical evolution is crucial for understanding its role in Eskişehir's urban development and the preservation of its cultural heritage.

Hamamyolu Çarşısı has played a central role within the city, and its historical fabric is rich and diverse. In the Byzantine era, it was utilized for recreation and as a market due to its natural hot springs (Doğru, 2005). Travelers who visited the city in the 1800s mentioned the existence of hammams and markets in this area (Acar, 2009). During the Seljuk period, baths were constructed because of the presence of hot springs, contributing to the city's economy and social life. The Erler Hamam, which still stands today in Hamamyolu Çarşısı, serves as an example of the hammams constructed during the Seljuk era (Doğru, 2005 and Altınsapan, 2009). The city, upon falling under Ottoman rule, experienced a period of stagnation. During the Ottoman period, several hammams were constructed in the city, such as the Şengül, Alçık, Kıymet (known today as Has Hamam), and Yenice (known today as Vakıflar Hamamı) hammams (Koşlu and Birgün, 2015; Acar, 2009). Hamamyolu Çarşısı, during the Ottoman era, was one of two main areas within the city (the other being the residential area known as Odunpazarı). This area was referred to as the market district where a marketplace was established, and soldiers used it as a rest area (Doğru, 2005). As observed from the city's foundation until the Ottoman period, it served various functions, including recreation, markets, shopping, and more. The character of Hamamyolu Çarşısı began to change in 1877 with the arrival of immigrants and the opening of the Baghdad Railway, marking the beginning of a transformation in the area.



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In 1877, Rumelian immigrants began to settle across the Porsuk River. These immigrants made positive contributions to animal husbandry and agriculture in the city. As a result, a weekly market established in the area was transformed into a fair that operated for 15 days under the order of the sultan (Kozak, 2013 and Albek, 1991). The influx of immigrants led to the formation of new neighborhoods within Hamamyolu Çarşısı. The Arifiye neighborhood, known today as Arifiye Mahallesi, is an example of the initial neighborhoods that emerged within Hamamyolu Çarşısı during this period. During this time, various types of buildings with different functions were constructed within Hamamyolu Çarşısı. The Pirinç İş Hanı, Ottoman Bank (now Garanti Bank), Taş Han, and the fountains built for using the hot springs are examples of such structures.

Table 1. Buildings Constructed in the Late 19th Century



Pirinç İşhanı (Personal Archive, 2021)



Taş Han (EKVKK, 2021)



Osmanlı Bankası - Present-Day Garanti Bank (EKVKK, 2022)



Fountains (Atuk, 2021)

The presence of the railroad and immigrants led to social changes in Hamamyolu Çarşı, resulting in spatial diversity. The presence of immigrant communities' nightlife influenced the city's way of life, leading to changes on a spatial scale. As an example of this, in the Çukur Çarşı area, there were not only coffeehouses but also taverns. It is worth noting that during this period, this location became home to one of the first taverns established by a Muslim in Anatolia (City Memory Museum, based on the oral history account by Kemal Yakut, 2022a). The presence of a tavern suggests the possibility of alcoholic beverage production in the city. During this period, the region of the hot springs housed Anatolia's first alcohol distillery (Sakarya Newspaper, 1982a).

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Figure 3. News about the alcohol factory opened in the 1800s (Sakarya Newspaper, 1982a)

In 1908, the city's first local newspaper, Nimet Newspaper, was published, and the newspaper's printing press was established on Taşbaşı Caddesi (Yakut, 2007). This information is also found in the Hakimiyet Newspaper;

"Zeytunzade Sadık Efendi brought a journalist named Mehmet Burhanettin to Eskişehir. He covered all the expenses and, in 1908, opened Nimet Newspaper. It was located at Taşbaşı, Number: 10" (quoted from Yakut, 2007).

In 1915, the Ottoman Agricultural Store was opened in Hamamyolu Çarşısı. The store's opening was reported in the Eskişehir Newspaper;

"Since the day our store opened, we have fulfilled our duty of gratitude for the favor and support we have received from our esteemed customers. It is especially requested from our dear customers, in their own interest, that they do not visit other shops once they come to our store for whatever they need. Eskişehir: Bonmarche in the Lower Market," (quoted from Yakut, 2007).

At that time, municipal activities were also observed in the market area. Various activities such as the repair of the Roman (Stone) Bridge, the opening of shops around the bridge, and the supply of clean water to the market area are mentioned. These activities were reported in Eskişehir and Hakimiyet newspapers;

"The wooden part of the market bridge deteriorated over time, leading to its reconstruction using iron pipes and the decision to build shops, cafés, and similar structures on both sides," (Eskişehir Newspaper, 1910; quoted from Yakut, 2007).

‘‘ Through a motor-driven distribution system, the municipal office delivers hot water to the residents, especially those in the lower and partly upper neighborhoods, and their efforts in ensuring the needs are truly admirable and superior,’’ (Hakikat Newspaper, 1911; quoted from Yakut, 2007).

This part mentions the opening of the first pharmacy in the city, Ömer Lütfü Pharmacy, near the Roman Bridge, offering both medicine sales and medical treatment services. Details regarding this can be found in the Metanet Newspaper;



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"Ömer Lütfü Eczanesi (Pharmacy). Dr. İstevraki Papayatoplu at Köprübaşı, Eskişehir. Specialist in internal medicine, surgery, and women's diseases. Dr. İstevraki conducts examinations daily. This announcement is made to the esteemed public." (From Metanet, 1912, as cited in Batur and Özdemir, 2018).

During this period, various buildings were constructed within Hamamyolu Çarşısı, increasing spatial diversity. The development of the street was met with destruction in 1922 due to the damage inflicted by Greek soldiers, who set fire to the shops and stores in the bazaar area.

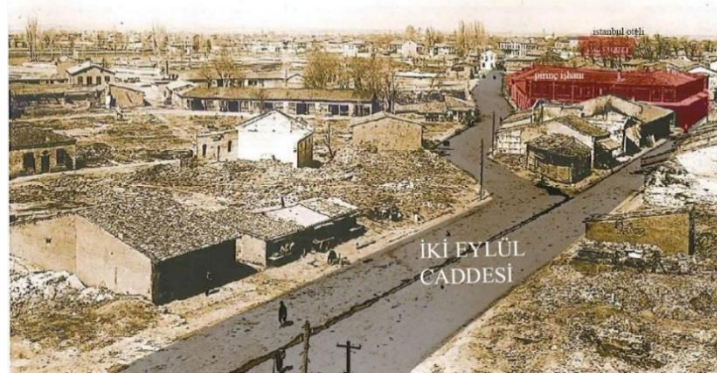


Figure 4. Hamamyolu Çarşısı After the Greek Occupation (Acar, 2009)

The damage caused to the city by the Greeks was reported in the Hakimiyet Newspaper:

"The guides of Western civilization, in a span of twenty-four hours, turned a city that would have had the most prosperous and promising future in Anatolia into ruins. We could not have foreseen that fire and flames would destroy it in all twenty-four aspects." as depicted in the image, the extent of the damage caused by the Greeks illustrates the magnitude of the destruction (Yakut, 2015). It is evident that the damage inflicted by the Greeks served as a turning point for Hamamyolu Çarşısı. In the early years of the Republic, the city attempted to recover from the inflicted damage while striving to keep up with the developments across the city. Following the liberation from the Greek occupation, the city sought to alleviate the economic and social repercussions of the damage incurred. Temporary permits were granted for new barracks constructed in the market area after it was burned by the Greeks. Cobblestone pavements were installed in the market district, and Yediler Park and Yediler Bridge were built (Ertin, 1994, and Güneş and Yakut, 2007). Information regarding the opening of Yediler Park and its heavy use during that period can be found in Vakit Newspaper:

"... Yediler Park, located in the heart of the city, was opened... The park saw some improvements this year. Last year, a large pool was built. This year, we see that park walls have been constructed, and the shapes of garden fences have changed. The park's radio plays from 17:00 to 22:30. At night, there are many people who come to the park to listen to the radio and take walks..."



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Figure 5. Yediler Park (Atuk, 2021)

During this period when hot springs were used, it can be observed that hot water was used both in public baths and in homes (Albek, 1994, Güneş and Yakut, 2007, and Eskişehir Halkevi Magazine, 1933). In the market area, you could find Erler (Men's), Asker (Kıymet) Bath, Şengilcık, Alçık, Yenice, Asri, and Şifa Bath. During this time, it was decided to reconstruct the Yenice Bath as it couldn't meet the requirements. The bath project, designed by the foreign architect of the time, Professor Deps, was initially proposed for implementation. However, it was considered unsuitable for Turkish customs and was later modified and carried out by Turkish architects (Özaktaş and Arsev, 1943). In 1923, a contract was awarded to prepare a map of the city as of that day. In 1924, the city's first urban plan was developed, dividing the city into different zones and planning its streets and roads based on the examples of European cities. This urban plan was partially implemented until 1936 (Planning Eskişehir in the 1930s, 2021).

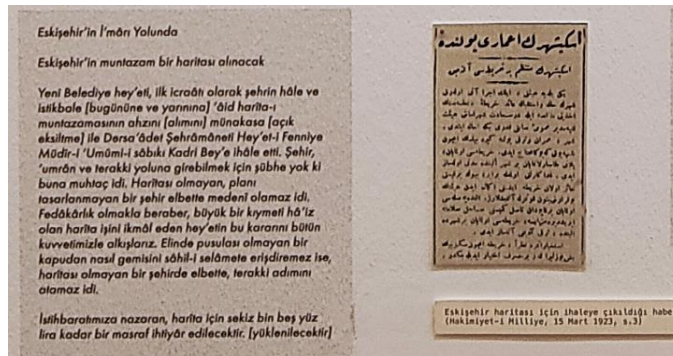
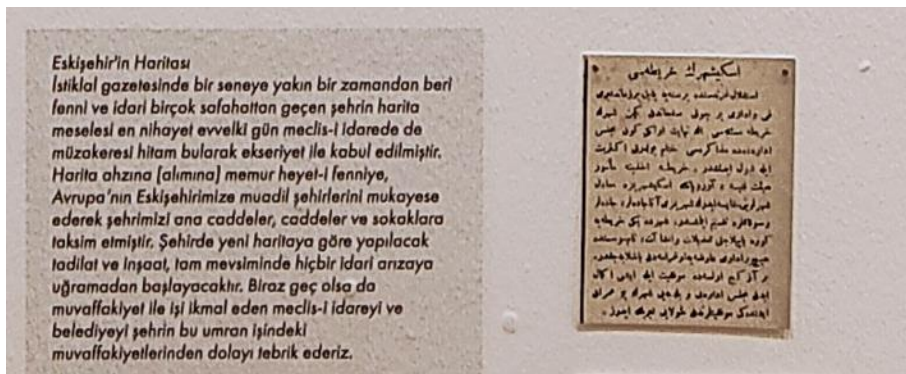


Figure 6. Announcement for the Tender of the City Map (Source: Planning Eskişehir in the 1930s, 2021)





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Figure 7. News of Approval for the City Map (Source: Planning Eskişehir in the 1930s, 2021)

In the zoning plan, changes can be observed in Köprübaşı, Taşbaşı Çarşısı, and İki Eylül Caddesi. In this zoning plan, some of the shops in Köprübaşı and Taşbaşı Çarşısı were allocated for road and pavement. However, due to financial constraints and resistance from the shopkeepers in the bazaar area, this zoning plan was not fully implemented. In the 1930s, this resistance was put to an end, and more than 300 shanties (temporary licensed shanties) in the bazaar area were demolished, and new brick shops were constructed in line with the city plan (Yakut, 2015 and Vakit, 1933). This situation is reported in the Akşam Newspaper:

"...an order has been issued for the demolition of more than 300 shacks within 48 hours. Now the shacks are being demolished, and preparations are being made for new construction. The city has had a regular plan dating back to 1924. Due to financial constraints, the municipality could only gradually implement this plan during construction. The demolition of the shacks will enable the implementation of a significant portion of this plan, leading to the opening of new streets and the expansion of narrow ones..." (Akşam, 1933).

The transformation on İki Eylül Avenue is as shown in Figure 8.



Figure 8. İki Eylül Avenue opened between 1924-1938 (Source: Planning Eskişehir in the 1930s, 2021)

This situation also indicates the influence of foreign architects and urban planners in the city. An example of this influence is the urban planning proposals made by the French urban planner H. Lambert in 1938-1939. News about Lambert preparing an urban plan for the city was reported in newspapers.

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Figure 9. The Eskişehir Plan Prepared by Lambert (Source: Planning Eskişehir in the 1930s, 2021)

The ongoing urban development activities led to the expansion of residential areas in the regions previously used as vegetable and fruit orchards. One of these neighborhoods is Arifiye Mahallesi located within Hamamyolu Çarşısı. In addition to residential structures, it can be observed that various buildings with different functions such as industrial facilities, cinemas, mosques, hotels, and restaurants were constructed within Hamamyolu Çarşısı during this period. This spatial diversity was depicted in the Akşam Newspaper with the headline "Eskişehir's landscape has changed.";

"...Construction is on the rise in the city, with new and large buildings going up everywhere. ... Wherever you go, you can see that several buildings are under construction... It seems like there are almost no empty plots left in the city center... The new buildings have altered the city's landscape... Eskişehir's streets are becoming more orderly..." (Akşam Newspaper, 1933).

During this period, Hamamyolu Çarşısı began to flourish as various structures were added, and it started to recover from the damages it had suffered. In this era, we can observe the construction of a mosque and accommodation buildings in Hamamyolu Çarşısı. The Çarşı Cami, Ziraat Bankası, Eskişehir Bankası, Köprü Palas Otel, Çağlayan Palas Oteli, Porsuk Oteli, Yasin Çakır Un Fabrikası, and the office building for the Yasin Çakır Un Factory were among the structures built during this period. While the Çarşı Cami, Ziraat Bankası, and the factory's office building (known as the İstanbul Oteli) still exist in Hamamyolu Çarşısı today, Köprü Palas Otel, Çağlayan Otel, Eskişehir Bankası, and the Yasin Çakır Un Fabrikası are no longer located in the area. The Yasin Çakır Un Fabrikası had mills along the banks of the Porsuk River, and thanks to these mills and dams, it was possible to take boat rides on the Porsuk River with ease (Akşam, 1934a). The opening of official institutions, banks, and the presence of the market in this area, among other factors, made Hamamyolu Çarşısı a focal point in people's daily lives. Additionally, with the opening of cinemas, restaurants, and other similar establishments, it became one of the most visited areas in the city. The opening of cinemas during this period, as reported in national newspapers of that time, is indicative of the lively social life taking place in the Çarşı district. Cinemas operated in Hamamyolu Çarşısı between the years 1926 and 1990. Some cinemas in the area also had gardens overlooking the Porsuk River. National newspapers



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provided information about these cinemas and their gardens, highlighting that the gardens served as meeting places (Akşam, 1934b).

"...Park Cinema's garden is also the second meeting point for Friday gatherings... This garden is bigger and more beautiful than Porsuk Hotel's garden... Here, there's a beautiful and crowded musical group. Most of the customers are the city's youth..." (Akşam, 1934b).

"...Modern and extensive neighborhoods have been established around Porsuk Creek, and buildings are rising. Köprübaşı has changed completely; old buildings have been demolished and replaced with large and tall concrete structures. To express how advanced the city has become, it's enough to say that it has five cinemas that could outshine Istanbul..." (Kurun, 1938).

In the 1960s and subsequent periods, various activities took place in Hamamyolu Çarşı. A casino building was constructed in the garden of the Porsuk Hotel.

"...In a short time, our city is at risk of losing its green spaces. Various parks and green areas have been replaced by buildings, leading to the disappearance of these parks... There is a plan to construct a hall and a casino in the part of the Municipal Park located by the Porsuk River. We expect that relevant authorities will prevent this situation and take into account the public's need for green spaces..." (Sakarya, 1963a).

These expressions highlight that the construction of casino buildings was not positively received due to the decrease in green spaces. The removal and damage to plants and pine trees within the garden during the construction are mentioned (Sakarya, 1963b). Another arrangement involved the reformation of Çukur Çarşı.



Figure 10. Çukur Çarşı (Source: Sakarya, 1982 ve Atuk, 2021)

Another change that occurred in the 1960s was in Yediler Park. The riverbed of the Akar Stream, which merges with Hamamyolu Avenue, was altered, and Sebahattin Günday Park was established.

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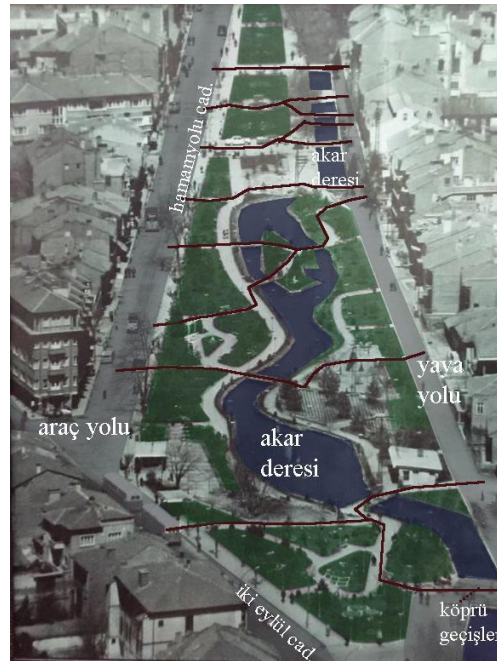


Figure 11. Yediler Park Transformed into a Park in the 1960s (Source: Atuk, 2022)

As a result of the park's arrangement, the newspapers of the time reported:

"... In the meantime, especially the new Yediler Park has attracted great interest from the public. In the evenings, it is impossible to find a place in the park, which is particularly favored by housewives. In the meantime, the municipality has made the fountain placed on the Akar Stream more colorful..." (Sakarya, 1967).

In the 1980s, Hamamyolu Avenue underwent changes due to the pollution of the stream that flowed along it. The local newspapers reported the pollution of the stream:

"... The Akar Stream, which passes through Sebahattin Günday Park (Yediler Park), the only sitting and children's play area in our city, has become quite dirty, spreading bad odors in the surrounding area due to complaints... (Milli İrade, 1987b).

"... Once upon a time, the Akar Stream used to flow sparkling clean and pure along the edge of Hamamyolu. In recent days, due to the careless disposal of garbage by the public and the authorities' lack of interest, it has turned into a pile of trash and filth..." (Sakarya, 1991a).

"... Due to this indifference, this beauty has almost disappeared, clean air has vanished, the waters have receded, and the riverbed has been filled with garbage residues as people have raced to do so... statues have been left alone with the trash..." (Sakarya, 1991b).

In the 1990s, the stream passing through Hamamyolu and Savtekin Streets, which flowed into the Porsuk River, was covered. Within the scope of the Hamamyolu Project, the goal was to cover the stream and replace it with three ornamental fountains adorned with fountains. As part of this project, the Emek Cafe, which had been in operation in the same location in Yediler Park for 29 years, was demolished. In addition to Emek Cafe, the bridges that had become symbolic of the stream were also demolished (Milli İrade, 1992a). The project aimed to transform the street into a green boulevard with cobblestone paving (İstikbal, 1993 and Milli İrade, 1992b and Sakarya, 1991c and Sakarya, 1992 and Sakarya, 1993a and Sakarya, 1993b). The new



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appearance of the street as a result of the Hamamyolu Project was described in local newspapers as follows:

"Only 10 years ago, the stream that added beauty to the city's appearance has now become history. The stream that once added beauty to the Yediler, Hamamyolu, and Sıcak Sular neighborhoods was cleaned, rehabilitated, and ultimately closed, effectively erased... The place where the stream, which used to nourish the willow trees and bring color with its cascades to Günday Park, once flowed, is now an empty space." (Milli İrade, 1992a).

"Hamamyolu residents, now free from the garbage-filled stream, wear smiles on their faces. Hamamyolu, considered as the only street worth showing in Eskişehir, is praised for its created fountains, the arrangements made, and the myriad beautiful flowers, and various types of trees that adorn it, making Hamamyolu a different kind of celebration now..." (Sakarya, 1993c).

In the 1980s, due to the inadequacy of the Porsuk Hotel building to meet the municipality's needs when it was used as the municipal building, a decision was made to construct a new municipal building (Sakarya, 1982c). Initially, the Çukur Çarşı area was considered suitable for the construction of this municipal building. However, this location was abandoned due to concerns about the stability of the ground (Sakarya, 1983). Subsequently, it was decided to build the municipal building on İki Eylül Caddesi, across from the Vilayet Building. During the period when the Municipal Building was constructed, the following statement described the structure:

"The ongoing construction of the new municipal palace, covering an area of 8390 square meters, was expected to surpass the Vilayet Building in terms of architectural significance upon its completion." (Milli İrade, 1987a).

As the 1990s approached, there was a renewed effort to rehabilitate the Çukur Çarşı area. In 1998 and the 2000s, Çukur Çarşı was demolished twice and is now as depicted in Figure 12.



Figure 12. Çukur Çarşı in 1998 and the 2000s. (Source: EKVKK, 2002 ve URL 1)

In the present day, an important development on Hamamyolu Street is associated with the Hamamyolu Park and Square Renovation Project, which was implemented in 2018 under the name "Hamamyolu Urban Deck" by Yazgan Architecture (URL 2). The construction process and the subsequent period were covered in newspapers. Regarding the new appearance of the street, newspapers featured the following expressions:

"Hamamyolu Street: Eskişehir's New Attraction Center... Hamamyolu, which the residents have already embraced, now features children playing games in specially designed play areas. Children seem to particularly enjoy the trampolines." (URL 3).

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"Intense Interest in Hamamyolu Street... Hamamyolu Street, with its new look, continues to attract significant attention from the public. Cafes serving teas, coffees, and Turkish coffee from various countries offer a wide range of options, from sandwiches to ice cream." (URL 4).

Under this heading, an attempt has been made to identify the historical turning points of Hamamyolu Çarşısı (Hamamyolu Bazaar) and its characteristics in the eyes of urban residents. The timeline for Hamamyolu Çarşısı is outlined as follows: Pre-Baghdad-Berlin Railway Era (Pre-19th Century Hamamyolu); The Arrival of Immigrants and Railway Construction (1894-1920); Hamamyolu in the Early Years of the Republic (1920-1960); Expropriation of the Sıcak Sular Bölgesi and Transformation of Yediler Parkı (1960-1980); Expropriation of Taşbaşı Çarşısı and the Hamamyolu Project (1980-2000); Demolition of Çukur Çarşı and the Commencement of Tramway Usage (2000-2010); Hamamyolu Park and Square Renovation Project on Hamamyolu Caddesi (2010 and the Present): This marks the latest development, which is the Hamamyolu Park and Square Renovation Project on Hamamyolu Caddesi. Throughout these stages, Hamamyolu Çarşısı is described as a place located in the city center, serving as a breathing space for urban residents, with a vibrant public life, and functioning as a recreational, commercial, and more space. This description is drawn from national and local media, travel narratives, and literature sources, illustrating its historical and contemporary significance in the urban context.

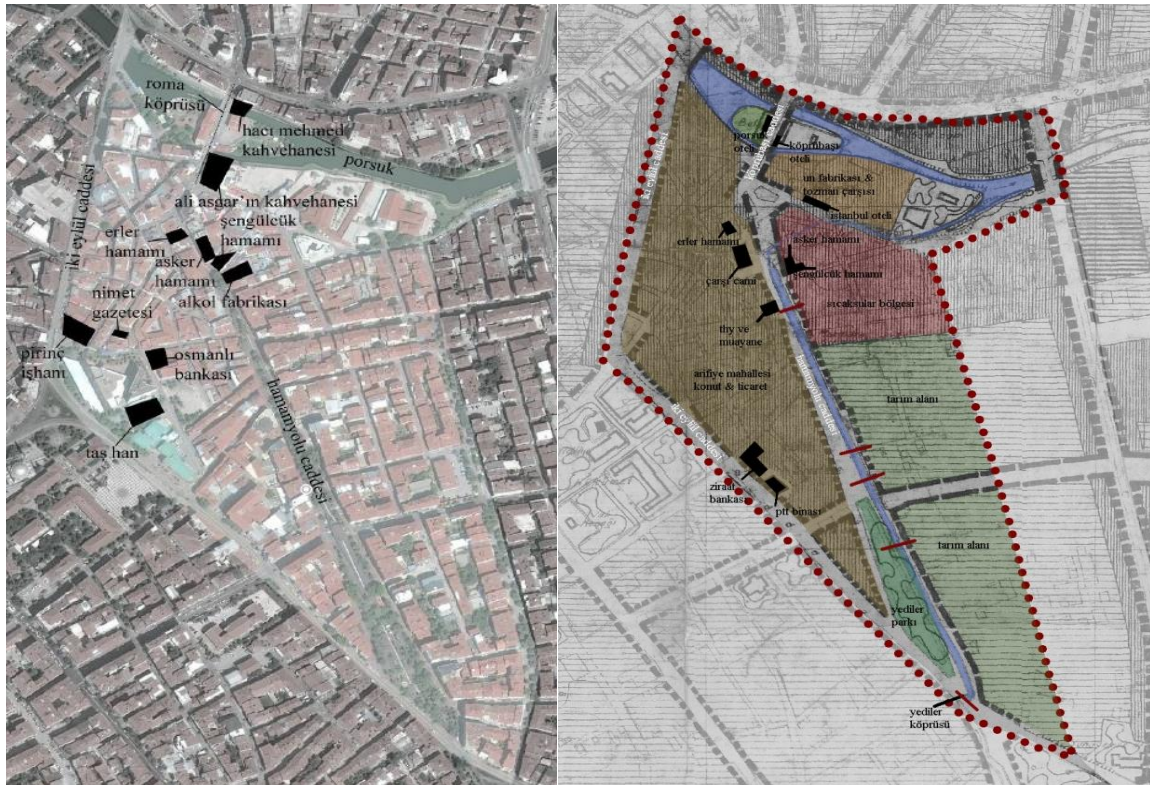


Figure 15. Structures Built between 1900 and 1950 (Source: Odunpazarı Municipality, 2022, and YandexMap)

a. The Spatial Analysis of Hamamyolu Çarşısı Using the Conzen Technique:

Conzen suggests that the morphological changes in a city can be tracked through urban landscape elements. For a morphological analysis, he considered the urban landscape elements

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to be street patterns, the relationship between filled and empty spaces, building block-parcel relationships, building-parcel relationships, and land use characteristics. Among these elements, he noted that street patterns are the most resistant to change, as they are defined as the boundaries of public spaces. In contrast, parcels and buildings undergo faster changes due to their connections with private property relationships (Şahin and Saban, 2020). The examination of urban planning reveals that the complex of the three elements defined as streets, parcels, and buildings in the urban area results in individualized combinations in different areas of the city. Each combination gains uniqueness due to location conditions, providing morphological homogeneity or unity in some or all aspects of the area. Urban plans continue to exist, develop, and function within the physical and human context. Therefore, plan analysis should encompass an evaluation of not only the physical conditions but also the economic and social development of the city (Conzen, 1960). Based on this, a spatial analysis of Hamamyolu Çarşısı will be conducted using Conzen's method, focusing on plans.

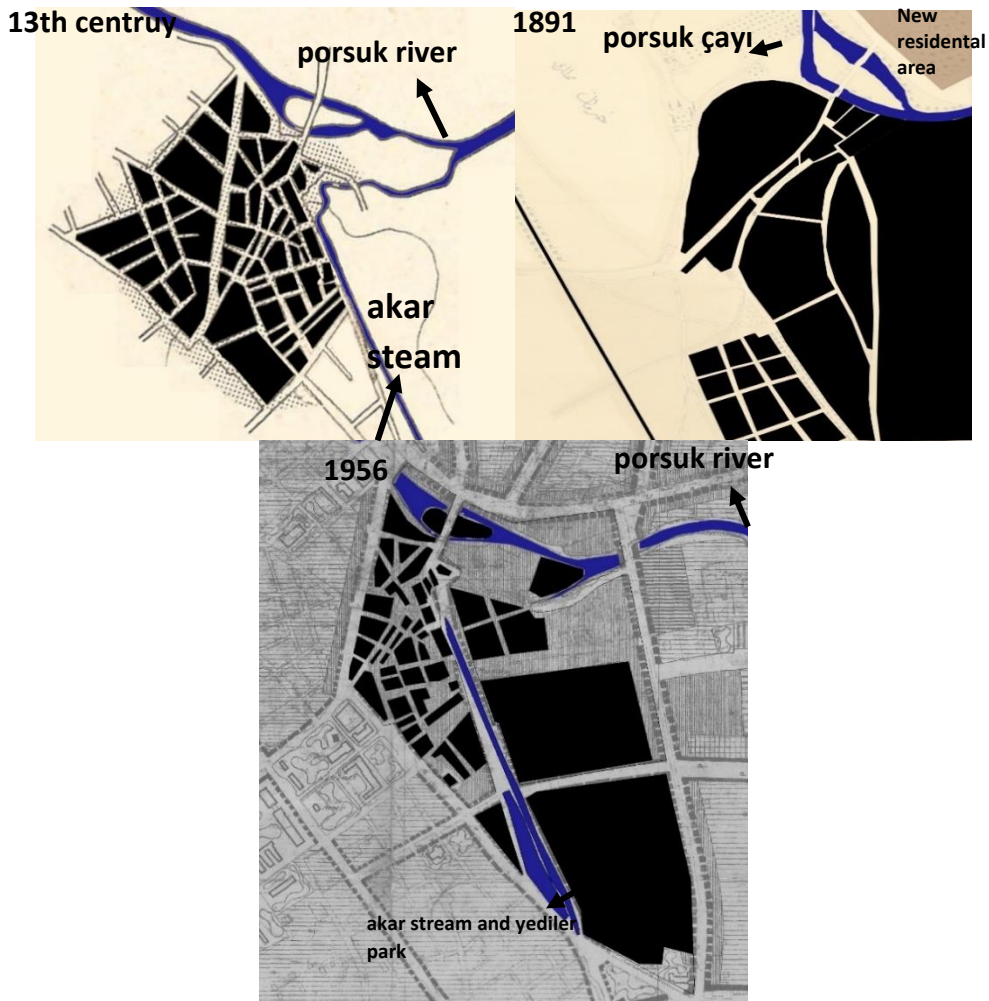


Figure 13. Land Use in Hamamyolu Çarşısı Over the Years (Source: Tanyeli, 1987; Koçlu and Birgün, 2015, Odunpazarı Municipality, 2022)

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When examining the maps from the 13th century, 1891, and 1956, it is evident that changes occurred in Hamamyolu Çarşısı on a building and parcel basis. In the 13th century, the Taşbaşı Çarşısı and the Sıcak Sular Bölgesi could be discerned on an island-parcel basis. In the 19th century, island-parcels expanded to cover a larger area, featuring garden usage. In the 20th century, the Taşbaşı Çarşısı and the Sıcak Sular Bölgesi displayed similarities. However, when compared to the 19th-century map, the Hamamyolu Çarşısı, with more distinct boundaries on an island-parcel basis, emerged. These differences can be attributed to various factors from that era, such as fires, the opening of different streets, and the condominium ownership law.

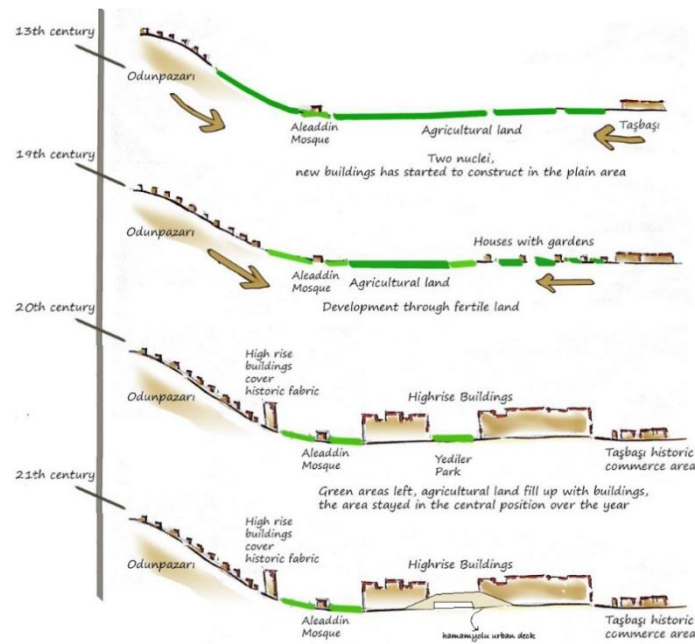


Figure 14. Schematic Representation of the Historical Development of Hamamyolu Çarşısı
(Adapted from Hakyemez, 2016, by the author for this study)

In the 13th century, it is observed that the area now known as the Sıcak Sular region, which was initially used for Taşbaşı Çarşısı, had some vacant plots around the Akar Dere. By the year 1891, due to the migration of people and the construction of the railway, there were notable differences in terms of spatial and land use. During this period, various markets were established in Hamamyolu Çarşısı, various spaces were constructed, and the area known today as Deliklitaş was used for farming and gardening. In the region known as Arifiye Mahallesi, residential and commercial areas were used alongside gardens. By 1956, it can be seen that the boundaries of Taşbaşı Çarşısı, including the Sıcak Sular Bölgesi, and Arifiye Mahallesi were being defined on an island-parcel basis, with recreational areas being utilized (Yediler Parkı). Even during this period, Deliklitaş Mahallesi had occasional residential settlements, but it was primarily used for gardening and farming (Figure 14).



Figure 15. Filled-Empty Analysis Over Different Years (Koylu and Birgün, 2015, Odunpazarı Municipality, 2022)

When examining the filled-empty analysis between 1891 and 1956, it is possible to see that within the emerging island-parcel boundaries (especially in Deliklitaş Mahallesi), there were occasional buildings, and Hamamyolu Caddesi was being used as a recreational area. Data obtained from newspaper articles and the Conzen analysis suggest that Hamamyolu Çarşısı has been an important space for the city in terms of commerce, recreation, and social aspects throughout its history, from the past to the present.

3. CONCLUSION and RECOMMENDATIONS

Urban morphology, in its broadest sense, helps us understand how a region within a city has undergone changes from the past to the present. In this study, the concept of urban morphology was used to identify the transformations and breakpoints that Hamamyolu Çarşısı has experienced from the past to the present. To achieve this goal, an attempt was made to identify the breakpoints of the market from newspaper articles. Based on the results obtained, the following periods were determined: Before the Baghdad-Berlin Railway (pre-19th century Hamamyolu); Arrival of Immigrants and Construction of the Railway (1894-1920); Early Years of the Republic in Hamamyolu (1920-1960); Expropriation of the Sıcak Sular Bölgesi and Transformation of Yediler Parkı (1960-1980); Expropriation of Taşbaşı Çarşısı and the Hamamyolu Project (1980-2000); Demolition of Çukur Çarşı and Commencement of Tramway Use (2000-2010); Hamamyolu Park and Square Arrangement Project on Hamamyolu Caddesi (2010 and the present). These breakpoints resulted from various factors, such as fires, the opening of different streets, and condominium ownership laws. The use of 'recreation' on the street, which has witnessed transitions from single-story buildings to multi-story buildings and from garden usage to residential-commercial use, has remained unchanged from the past to the present. Hamamyolu Çarşısı, which constitutes the first commercial nucleus of Eskişehir,



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consists of baths, business buildings, passages, row shops comprising adjacent shops, banks, mosques, cinemas, residences above the shops, trees on the street, and, although it is closed today, a water element passing through it and green park areas. When examined through the concept of urban morphology, it is evident that Hamamyolu Çarşısı has a rich historical process.

Thanks and Information Note

The data used in this study, including newspaper articles, plans, etc., were obtained and developed from the author's master's thesis titled 'Reading Changing Urban Memory Elements Through Shopping Spaces: The Case of Hamamyolu Çarşısı,' which the author completed in 2022.

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BENCHMARKING OF 3D PRINTED CONCRETE WITH SELECTED BUILDING MATERIALS IN TERMS OF ENERGY EFFICIENCY AND CARBON EMISSIONS

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ABSTRACT

Natural disasters such as earthquakes and fires trigger the need for urgent housing, therefore, rapid manufacturing technologies are being developed. With the use of 3d printing (3DP) technology, structures can be built in more economical and faster ways. However, the measures should be taken in terms of energy efficiency and environmental impact due to the use of cement-based materials with high initial embodied energy. The most common contemporary building materials are autoclaved aerated concrete (AAC) and brick in Turkey. Therefore, it is aimed to compare the energy consumption and global warming potential of AAC, brick and 3d printed concrete (3DPC) in this study. These materials have the same wall thicknesses with different thermal conductivity (U) values in accordance with TS 825, national thermal insulation rules. The system boundary covers the production (A1-A3) and use (B6) stages. Because of being the third most populated province of Türkiye and the location in the first-degree seismic zone, Izmir was selected as the study area. Design Builder software was used to calculate the operational energy and carbon values; and environmental product declarations (EPDs) were used for the production stage. According to the results, the total energy consumption increases in the 3DPC by 20.4% and 17.7% compared to AAC and brick alternatives, respectively. On the other hand, using foam concrete in 3d printing may assist to reduce operational energy and carbon values up to 9.6% .

Keywords: 3D Printed Concrete, 3D Printed Foam Concrete, Building Materials, Energy Consumption, Carbon Emission.

1. INTRODUCTION

While the world is struggling with the climate crisis, it also has to deal with natural disasters. Due to earthquakes and fires that affect masses of people, many of them can suddenly become homeless and have difficulty meeting their basic needs. In such emergencies, there is a need for durable structures to be built with rapid manufacturing technologies. Since the extent of the disaster and the duration of the victimization are unknown, sheltered structures should be built to be minimally affected by external environmental conditions. On the other hand, considering global warming and resource depletion, the energy consumption of these structures should be reinterpreted and evaluated within the framework of a sustainable approach.



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3d printing (3DP) technology has the potential to be used in emergency housing construction thanks to its advantages such as fast installation, sustainability, and affordability (Markin et al. 2021; El-Sayegh et al. 2020). Compared to traditional construction methods, the 3DP technique offers an efficient, economical, and reliable solution (Ahmed, 2023). Besides its ability to minimize material waste by reducing material costs, 3DP can reduce 50-80% of the total cost of the project in terms of labor. This reduces the number of project employees required, minimizes occupational accidents and injuries, and reduces the cost due to human failures. Thus, the total project cost can be reduced by 35-60%. The 3DP method greatly shortens the construction time, with a 25% reduction compared to a house built with traditional methods (Craveiro et al., 2020; Shomberg, 2016). One of the fundamental reasons for the decline in worker productivity is the failure to integrate new technologies such as 3D printed concrete (3DPC), also known as additive manufacturing (El-Sayegh et al. 2020). This technology has the potential to transform construction processes by gaining an important place in the building industry.

Foam concrete is a cementitious material with a low self-weight. Its light weight is due to the addition of air to the matrix of a suitable foam formed with cement paste. It is preferred in the construction industry due to its advantages over normal concrete such as low self-weight (Wei et al., 2013), thermal insulation (Amran et al., 2015), acoustic absorption (Tada, 1986), fire resistance (Valore, 1954) and workability (Chica & Alzate, 2019). However, ultra-low-density foam concretes may have low mechanical strengths and potential instability issues (Jones et al., 2016; Jones et al., 2017). Mechanical properties depend on dry density as well as foaming agent, curing condition, cement type, and water/cement and air/cement ratios. A new type of 3DP technique involving lightweight foam concrete (3DP-LWFC) offers several advantages such as the ability to maintain dimensional stability in the fresh state, architectural flexibility, and material savings owing to the automated extrusion production process (Falliano et al., 2020). This material stands out as a potential solution in the construction industry by providing energy savings and environmental advantages. 3DP-LWFC contributes to energy efficiency with its high insulation performance saving construction cost and time (Markin and Mechtcherine, 2021).

Among studies on 3D printing, which has been utilized in bridges, residences, offices, and emergency shelters, the number of those specifically addressing energy efficiency (Suntharalingam et al. 2021; Alkhalidi and Hatuqay, 2020; Pessoa et al. 2021) and environmental impacts (Shuaib et al. 2021; Khosravani and Reinicke, 2020) has recently increased. Some of the studies suggest that the use of 3DPC with only air cavities is not sufficient in terms of thermal performance. Suntharalingam et al. (2021), found that the cavities do not satisfy the U value according to standards. The lowest U value was achieved as 0.34 W/m²K with the help of insulation. In another study, Alkhalidi and Hatuqay (2020) achieved to design a wall with a U value of 0.15 W/m²K. They designed a double-row, insulation-filled wall made of 100% silica sand, and the thickness of the wall is 0.5 m.

The aim of this study is to quantify the energy performance and carbon emission of 3DPC and 3DP-LWFC in the most energy intensive life cycle phases, A1-A3 (production) and B6 (use), in construction industry and to compare them with contemporary building materials in Izmir climate conditions.

2. MATERIALS and METHODS

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Izmir, which is located in the 1st degree earthquake zone is the third most densely populated province of the country, was selected as the case area for the study. Dikili, which is affiliated to this province, is among the regions whose population increases with the influx of tourists in summer. A hypothetical house with a floor area of 100 m² and belonging to a family of 4 people was chosen as the subject of the study. The plan diagram and the 3D model produced in Design Builder are shown in Figure 1.

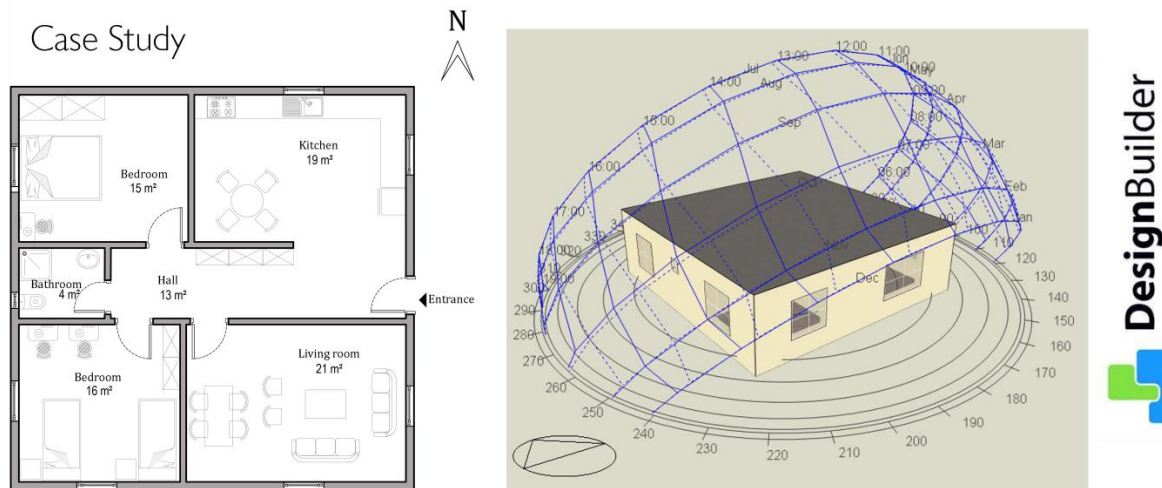


Figure 1. Plan scheme of the case study house (left), 3d model (right)

The energy consumption and related carbon emissions of this house, which was produced with autoclaved aerated concrete (AAC), brick, 3D printed concrete (3DPC), and 3DP-LWFC wall alternatives, were examined within the scope of the pre-occupancy and occupancy phases of the building. The climate data of the relevant region used in Design Builder, an energy simulation program, was taken from Url-1. While designing the openings of the house, the window-to-wall ratio (WWR) on all facades was set to 20%. The indoor temperature in the simulation environment is 21°C in summer and winter, set points were 27°C and 15°C for summer and winter, respectively. Heating is active between October-March while cooling is between June-September, from 07:00 am to 23:00 pm.

When designing the wall components, the wall thicknesses were kept constant, the standard dimensions of the main building material were selected for the exterior and interior walls, and the thickness of insulation layers of the facade were determined. 3DPC was used in three layers and the gaps were filled with insulation material since it has a thin layer and does not meet the standard thermal conductivity value by itself. The properties of the selected materials were obtained from environmental product declaration (EPD) files and literature studies (Marais et al. 2021). Thermophysical properties of three different exterior wall alternatives are given in Table 1. According to TS 825, the U value for the 1st degree day zone is 0.66 W/m²K and the designed wall configurations are below this value. The values specified in TS 825 standard were taken as the basis for the selection of roof, flooring, windows, and doors in accordance with the selected material.



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Table 1. Wall configuration of the selected materials (A0X: Alternative 0X)

AAC	Materials for A01	Thickness (m)	Density (kg/m³)	Thermal conductivity (W/mK)	Specific heat (J/kg K)
	Exterior plaster	0.03	1000	0.4	1000
	AAC	0.25	600	0.16	1000
	Interior plaster	0.02	1000	0.4	1000
	U value (W/m²K)	0.53			
	Total wall thickness (m)	0.3			
BRICK	Materials for A02	Thickness (m)	Density (kg/m³)	Thermal conductivity (W/mK)	Specific heat (J/kg K)
	Exterior plaster	0.03	1000	0.4	1000
	Mineral wool	0.06	70	0.035	840
	Hand-made brick	0.19	1700	0.84	800
	Interior plaster	0.02	1000	0.4	1000
	U value (W/m²K)	0.44			
	Total wall thickness (m)	0.3			
3DPC	Materials for A03	Thickness (m)	Density (kg/m³)	Thermal conductivity (W/mK)	Specific heat (J/kg K)
	Exterior plaster	0.03	1000	0.4	1000
	3DPC	0.05	1700	0.74	1000
	Mineral wool	0.05	70	0.035	840
	3DPC	0.05	1700	0.74	1000
	Mineral wool	0.05	70	0.035	840
	3DPC	0.05	1700	0.74	1000
	Interior plaster	0.02	1000	0.4	1000
U value (W/m²K)	0.29				
	Total wall thickness (m)	0.3			
3DP-LWFC	Materials for A04	Thickness (m)	Density (kg/m³)	Thermal conductivity (W/mK)	Specific heat (J/kg K)
	Exterior plaster	0.03	1000	0.4	1000
	Foam concrete (3DP-LWFC)	0.05	1400	0.37	1100
	Mineral wool	0.05	70	0.035	840
	Foam concrete (3DP-LWFC)	0.05	1400	0.37	1100
	Mineral wool	0.05	70	0.035	840
	Foam concrete (3DP-LWFC)	0.05	1400	0.37	1100
	Interior plaster	0.02	1000	0.4	1000
U value (W/m²K)	0.28				
	Total wall thickness (m)	0.3			



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The unit embodied energy and carbon values are given in Table 2. Since the EPD for 3DP-LWFC is not available, the embodied energy and carbon values of this material are not known and the results for this material only cover the B6 stage. In the conclusion part, the outputs obtained are given from the point of 3DPC and then in comparison with 3DP-LWFC. The volume of the materials used in the building was taken by using 'schedules' in the Revit program.

Table 2. Embodied energy and carbon values for production stage (Ytong EPD, 2015; Saray Brick EPD, 2022; Akdağ EPD, 2022; Sikacrete EPD, 2022)

Material	Functional Unit	System Boundary	Embodied energy intensity (MJ)	Embodied carbon (kgCOe)
AAC	m ³	A1-A3 (cradle to gate)	1342.6	167.1
Brick	m ³		4779.7	425.7
3DPC	m ³		19737.0	829.6
Mineral wool	m ³		1010.3	82.0
3DP-LWFC	-		-	-

The system boundaries covering the production (A1-A3) and use (B6) phases for the relevant materials are shown in Figure 2. The most energy-intensive processes of the materials were marked in red. As cement is heated at high temperatures, it can result in significant energy consumption. The portland cement ratio of AAC is between 15-30% by mass. Even if there is no cement in hand-made brick, the long-lasting baking process of the brick (13 hours) can also increase the energy demand. The melting process of the ingredients of mineral wool at temperatures higher than 1500°C should be considered in terms of energy requirement. It should be noted that in the EPD file of 3DPC, the worst-case scenario results of the product were taken into account for the embodied stage. The inorganic binder mass ratio is stated to be between 2-98%. In this case, more than 90% of cement could have been used (Figure 2).

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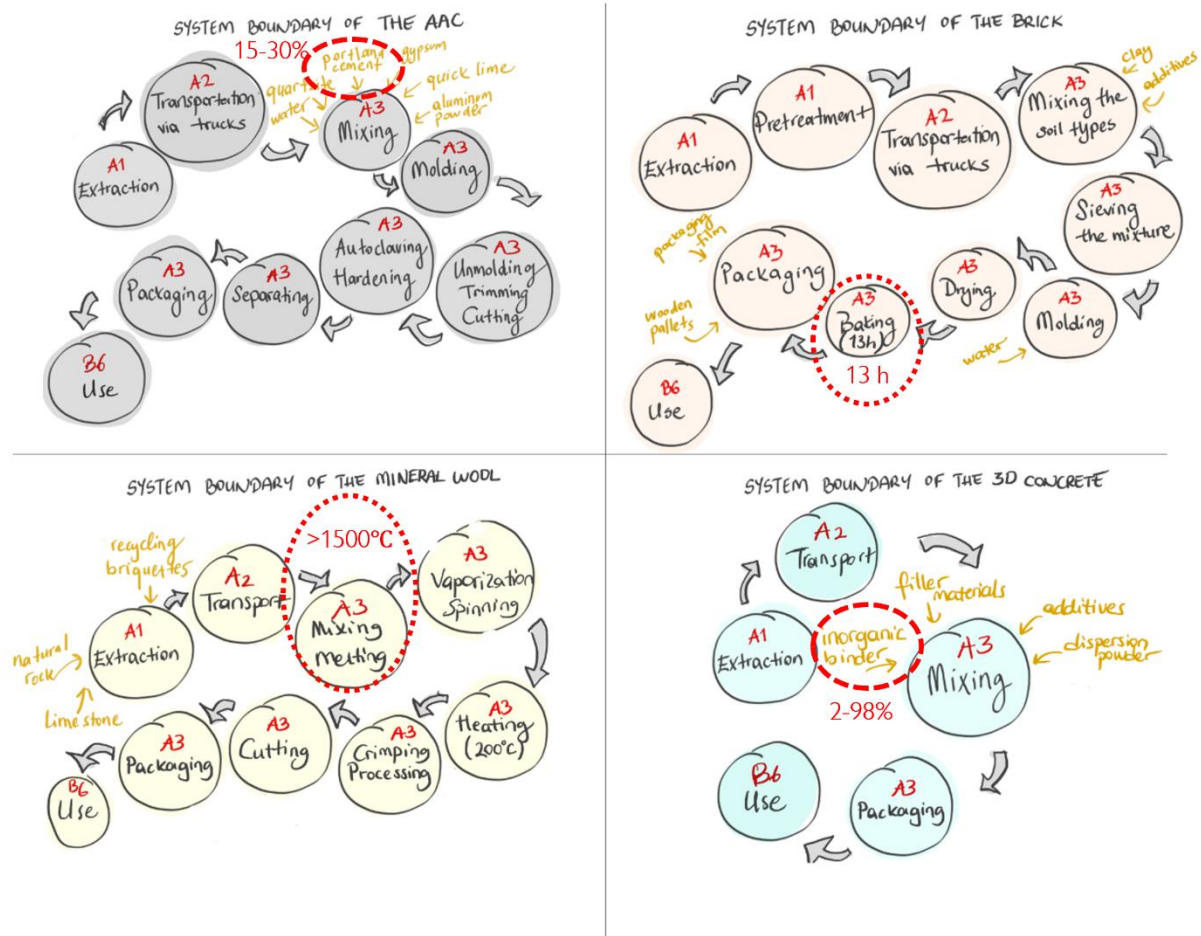


Figure 2. System boundaries of the AAC, brick, mineral wool and 3DPC

3. FINDINGS and DISCUSSION

The energy and carbon emission values obtained for each of the three façade alternatives were analyzed for the processes of extracting the raw material (A1), transporting the material to the factories for processing (A2), manufacturing the building material (A3) and using in the building (B6). Accordingly, it is seen that the ranking in terms of embodied energy and carbon values spent for the production phase is AAC, brick, and 3DPC from better to worse (Table 3).



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Table 3. Embodied energy and carbon values in the A1-A3 stages

Materials	Volume (m ³)	Embodied Carbon (kgCO ₂ e)	Embodied Energy (MJ)
AAC	26.48	4,425	35,552
Total (A01)		4,425	35,552
Brick	22.98	9,782	109,838
Mineral wool	6.72	551	6,789
Total (A02)		10,333	116,627
3DPC	20.33	16,866	401,253
Mineral wool	11.2	18	11,315
Total (A03)		17,784	412,568

Since the energy values spent during the use phase of the building were obtained from the Design Builder program in kWh, the relevant values were multiplied by a factor of 3.6 and converted to MJ; thus, it was aimed to evaluate the energy consumption of the building in pre-use and during use stages together. In order to calculate the amount of energy consumed by the building during its lifetime, the service life of the building was assumed as 50 years. According to the results, the reduction in U-values by almost half in the 3DPC option led to a gain of 3.9% and 0.9% in primary energy consumption from heating, cooling, hot water, and lighting during the use process compared to AAC and brick, respectively (Table 4).

Table 4. Operational energy consumption in the B6 stage (DHW: Domestic hot water)

AAC (A01)	Lightening	Heating	Cooling	DHW	Primary Energy use
MJ/m ² /year	28.7	136.4	96.8	42.0	304.1
For the entire service life (MJ, 50 years)					1,520,363
Brick (A02)	Lightening	Heating	Cooling	DHW	Primary Energy use
MJ/m ² /year	28.9	128.6	95.2	42.2	295.0
For the entire service life (MJ, 50 years)					1,474,956
3DPC (A03)	Lightening	Heating	Cooling	DHW	Primary Energy use
MJ/m ² /year	24.9	138.3	92.8	36.4	292.2
For the entire service life (MJ, 50 years)					1,461,042



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In terms of annual carbon emissions from energy consumption, the building alternative with AAC emits 3.5 tons of carbon per year, with brick 3.4 tons, and with 3DPC 3.3 tons. The gains in the case of 3DPC are 6.3% and 4.8% compared to AAC and brick, respectively (Table 5).

Table 5. Annual operational carbon emission in the B6 stage

Annual operational carbon	A01	A02	A03
Total (kg)	3,539	3,484	3,317

In A03, the energy requirement during the production phase of the building may be higher than the others due to the fact that 3DPC contains cement as an inorganic binder (2-98% by mass) and this ratio is kept high due to the worst-case scenario as stated in the EPD file. The reason for the rise of the brick may result from the baking process lasting for 13 hours. In terms of annual operational energy, AAC requires slightly more energy than the others while 3DPC exhibits a less energy-intensive attitude thanks to its thicker layer of insulation. In line with energy use, carbon emissions are in the same sequence (Figure 3).

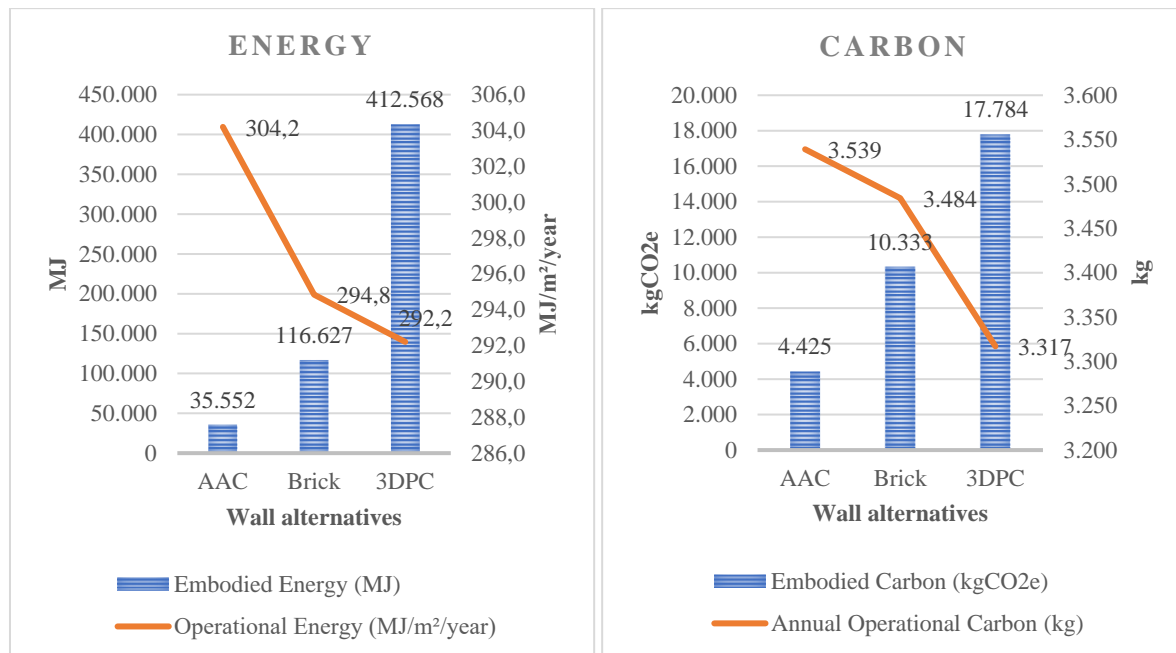


Figure 3. Energy and carbon performance of the wall alternatives

Considering the total energy need of the building within the scope of 50 years of the life cycle, the energy distributions were 1,555 GJ for A01, 1,591 GJ for A02, and 1,873 GJ for A03. Considering 50 years of life cycle, 3DPC causes energy losses of 20.4% and 17.7%, compared to AAC and brick, respectively. In terms of global warming potential, it leads to a 1.26% rise compared to AAC, whereas a 0.45% of reduction compared to brick (Table 6).



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Table 6. The total energy use of the wall alternatives and savings of 3DPC

Wall alternatives	Operational Energy (MJ, B6, 50 years)	Embodied Energy (MJ, A1-A3)	Life Cycle Energy (MJ)
A01- AAC	1,520,363	35,552	1,555,915
A02- Brick	1,474,956	116,453	1,591,409
A03- 3DPC	1,461,042	412,568	1,873,610
Saving compared to AAC (%)	3.9	-1060.5	-20.4
Saving compared to Brick (%)	0.9	-253.7	-17.7
Wall alternatives	Operational Carbon (MJ, B6, 50 years)	Embodied Carbon (MJ, A1-A3)	Life Cycle Carbon (MJ)
A01- AAC	176,955	4,425	181,380
A02- Brick	174,200	10,318	184,518
A03- 3DPC	165,890	17,784	183,674
Saving compared to AAC (%)	6.3	-301.9	-1.26
Saving compared to Brick (%)	4.8	-72.1	0.45

The reason for the low energy gain (0.9%-3.9%) of 3DPC in the use phase despite the 10 cm insulation layer may be the low thermal properties of the material. Therefore, the second part of this study aims to compare 3DP-LWFC, which has higher thermal performance, with other building materials. Since the properties of 3DP-LWFC were taken from a study (Marais et al. 2021), an EPD file for the same material was not available. Therefore, comparisons are only considered for the use phase (B6). The primary energy consumption of the structure built with this material and the gains obtained compared to other alternatives are given in Table 7.

Table 7. Operational energy consumption, annual carbon emission and savings of 3DP-LWFC

Foam concrete 3DP-LWFC (A04)	Lightening	Heating	Cooling	DHW	Primary Energy use
MJ/m ² /year	28.5	114.1	90.7	41.7	274.9
For the entire service life (MJ, 50 years)	1,374,462				
Annual operational carbon (kg)	3,308				
Savings of 3DP-LWFC;	Operational Energy Savings (%)	Operational Savings (%)	Carbon		
Compared to A01 – AAC	9.6	6.5			
Compared to A02 – Brick	6.8	5.1			
Compared to A03 – 3DPC	5.9	0.3			

According to the results, 3DP-LWFC has better energy performance with a gain of %9.6 compared to AAC; %6.8 compared to brick, and %5.9 compared to 3DPC. These gains reflected the carbon emissions a reduction of %6.5, %5.1, and %0.3, respectively. As can be seen from the results, superior thermophysical features enhance energy savings. Therefore, the development of higher quality energy-efficient materials would help to reduce energy demand.



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4. CONCLUSION and RECOMMENDATIONS

Developments in technology guide architectural design and material selection processes. Thanks to 3D printing technology, which is one of these developments, it is possible to construct living spaces more economically and quickly, based on fewer labor requirements and with fewer waste problems. In addition to all these criteria, this study aims to test the effects of 3DPC on global warming potential and consumption of energy resources within the scope of environmental sustainability. For this purpose, the energy consumption and carbon emissions of AAC and brick, which are the most preferred contemporary building materials in Turkey, were evaluated in the embodied and operational processes with 3DPC.

According to the results, it has been observed that 3D printing technology, which offers advantages in many aspects, does not provide the desired results in terms of lifetime energy consumption and carbon emissions. AAC and brick are much more environmentally friendly than 3DPC, especially during the production phase. However, this may be because, as stated by the company, the worst-case results are included in the EPD file of the material.

In the second part of the study, the energy and carbon performances of foam concrete with improved thermal properties in 3D printing, as mentioned in another study, were evaluated separately for the use phase of the building. Thus, the effects of improved properties such as thermal conductivity, density, and specific heat on energy performance were examined. As a result, it was found that energy gains were increased by 2 to 7 times and carbon emissions were reduced, albeit negligibly. Since there is no EPD file for 3DP-LWFC, the energy and carbon levels during the production phase could not be evaluated.

The results of the study show that standard 3DPC does not have the lifetime energy performance to compete with contemporary building materials, but the gap can be closed with new-generation materials with improved thermal properties, such as foam concrete. In addition, the use of cement-free materials can reduce embodied energy.

Prospectively, life cycle phases can be studied more comprehensively, considering hazardous waste, initial investment, maintenance, and repair costs, and the consumption of other resources such as water and raw materials. By comparing new generation and/or traditional materials that are widely used today, it is possible to reveal their advantages and broaden the perspective of material producers to enable the production of materials that are environmentally friendly, have high energy performance, and offer convenience in many other ways.

Thanks and Information Note

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**INVESTIGATION OF OPERATIONAL AND EMBODIED ENERGY
THROUGHOUT THE LIFE CYCLE OF BUILDINGS WITH BIBLIOMETRIC
ANALYSIS: A LITERATURE REVIEW**

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ABSTRACT

In the world, 40% of the energy use and 30% of greenhouse gas emissions are caused by the construction industry. Buildings consume both embodied and operational energy during their entire life cycle. Recently, measures have been taken to reduce both types of energy. However, to make further progress, it is necessary to know the current stage. Therefore, the major objective of this study is to provide the theoretical background for future research by conducting a bibliometric analysis of 122 publications from the Web of Science (WOS) database over the last ten years. Results were examined under four key themes that emerged from the publications that reviewed: research topics, building types, software & databases, and materials. The studies comprise embodied and operational energy conducted in various research fields such as energy, carbon, cost, climate, comfort, design alternatives, etc., using a whole range of databases and software programs. The building types were studied according to their height, size, function, refurbishment, and certification status. Although there are studies carried out on the whole building scale, some of them were conducted on the material scale that consists of traditional, contemporary, prefabricated, recycled, or green building substances. As a result, it was concluded that buildings should be examined from a holistic perspective at the design stage in order to determine resource use, environmental impacts, budget, and user comfort.

Keywords: Operational Energy, Embodied Energy, Life Cycle Assessment, Buildings, Bibliometric Analysis.

1. INTRODUCTION

Evidence of global warming and climate change has become clear, with 2014 being the warmest year on record (dating back to 1880) and most of the warmest years after 2000 (R. H. Crawford, Bartak, Stephan, & Jensen, 2016). To address this critical challenge, there is a need to reduce greenhouse gas emissions, and buildings play a crucial role in this effort. In developed economies, buildings alone account for 30-40% of the primary energy demand and construction is one of the most energy-intensive sectors (IEA, 2022). Construction sector is the primary contributor to carbon emissions, accounting for 40% of energy-related emissions. Within this 40%, 12% is attributed to embodied carbon related to various building life cycle stages. The remaining 28% represents carbon offset, originating from energy usage in building operations,



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including heating, cooling, and electrical appliances (Azis, Memon, Rahman, Nagapan, & Latif, 2012; Khan et al., 2022; Soust-Verdaguer et al., 2022).

If significant improvements in building efficiency are not made, greenhouse gas emissions from the construction and building industry could double in the next 20 years due to urban sprawl (UNEP, 2009). The carbon emissions and energy use associated with buildings occur throughout their life cycle, including material extraction, manufacturing, construction, operation, and end-of-life (Ramesh, Prakash, & Shukla, 2010). Building construction and operation consume a considerable amount of energy and have a great environmental impact (R. Crawford, 2011). Embodied energy and operational energy are two critical concepts for environmental sustainability. Embodied energy refers to the energy consumed in the production of building materials and includes the total energy required for the extraction, processing, production, and transportation of materials. On the other hand, operational energy refers to the energy consumed in the use stage. Embodied energy plays a critical role in design and material selection by determining the environmental impacts of building materials in their production processes, whereas operational energy is a critical factor in improving the energy efficiency of buildings and moving towards low-carbon energy sources. Rapid population growth and urbanization further exacerbate the pressure on natural resources and the environment, as the construction sector currently accounts for approximately 36% of global energy consumption and 40% of process-related emissions (IEA, 2018). Considering that buildings consume nearly half of the global energy each year and contribute significantly to carbon emissions, it is important to develop more sustainable and resource-friendly solutions within the construction sector (Poveda & Young, 2015; Schandl et al., 2018). The concentration of carbon in the atmosphere has reached record levels, leading to noticeable global warming and extreme weather events. Therefore, urgent action is needed to investigate energy performance during the building life cycle.

Bibliometrics is a method used to assess the structure and development of scientific fields or to map and analyze specific disciplines (Boyack, Klavans, & Börner, 2005). Bibliometric research evaluates the data obtained using various statistical techniques (McBurney & Novak, 2002). These evaluations are carried out via various research parameters such as publication years, research topics, authors, institutions, keywords, citations, and research methods. These reviews are accompanied by findings to assess the current status and development over time of a discipline, book, journal, paper, institution, country, etc. (Pritchard, 1969). Furthermore, through various bibliometric indicators, the scientific publishing behavior and dynamics of countries, universities, and institutes can be determined (Pechlaner, Zehrer, Matzler, & Abfalter, 2004).

This study provides a systematic literature review that aims to identify key issues and factors in building embodied and operational energy. In the study, the following research objectives are pursued:

1. By using bibliometric analysis, identifying commonly used keywords, key concepts, most influential authors, universities, countries, and articles.
2. Reviewing and summarizing the current trends, practices, and limitations related to operational and embodied energy in buildings.



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3. Focusing on the results of the study by identifying potential solutions to the identified problems, future research topics, and opportunities.

2. MATERIALS and METHODS

To investigate the state of the art of operational and embodied energy analysis in building life cycle, the most frequently used keywords are determined to describe the subject. ("Life Cycle Energy" OR "Life Cycle Carbon" OR "Life Cycle Assessment" OR "LCA") AND ("Building" OR "Construction") in the title, AND ("Embodied" AND "Operational") in the title, abstract, and keywords, between 2013 and 2023 index to search are analyzed. The language, "English" was selected and chosen document type "Article" OR "Review" was examined with VOSviewer and Bibliometrix, software tools for visualizing and obtaining bibliometric datasets. Keywords, language, and research field limitations apply to the research criteria (Figure 1). The most frequently cited articles, authors, countries, years of publication, the total number of publications by country, research area, sources, organizations, factor analysis, frequently used keywords, and content are examined in the literature review analysis on operational and embodied energy analysis of building life cycle in the construction industry. Web of Science database is used to obtain an accurate and reliable bibliometric network. Based on the analysis of the WOS database, 122 articles were found to be indexed SCI-Expanded, SSCI, ESCI, and A&HCI. The summary of the methodology can be seen in Figure 1.



Figure 1. Methodology of the scientific review

Before proceeding with visual and scientific mapping, it is necessary to briefly evaluate the documents that constitute the universe of the study. According to analysis, the annual growth of published research is 17.46% and there is an average of 26.39 citations per publication. 122 publications were obtained as a result of the research criteria on operational and embodied energy throughout the life cycle of buildings with a total of 365 authors and 33 sources of publication.

3. FINDINGS and DISCUSSION

In this section, the results of the bibliometric analysis are presented in detail. The analyses provide a comprehensive view of the current state and development of the discipline, offering



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valuable insights to researchers, academics, and relevant stakeholders. These results provide information for future researchers in related fields.

3.1. Annual Publication Analysis

The distribution of the number of studies throughout time is a key factor in determining the depth of a subject. Figure 3 shows the total number of publications in the period 2013-2023. It is observed that among 122 publications on this subject, 13% of them were published in 2020 and 16% in both 2021 and 2022. The sustainable development goals in the EU and the importance of this issue in other countries around the world in recent years have played a major role in this situation.

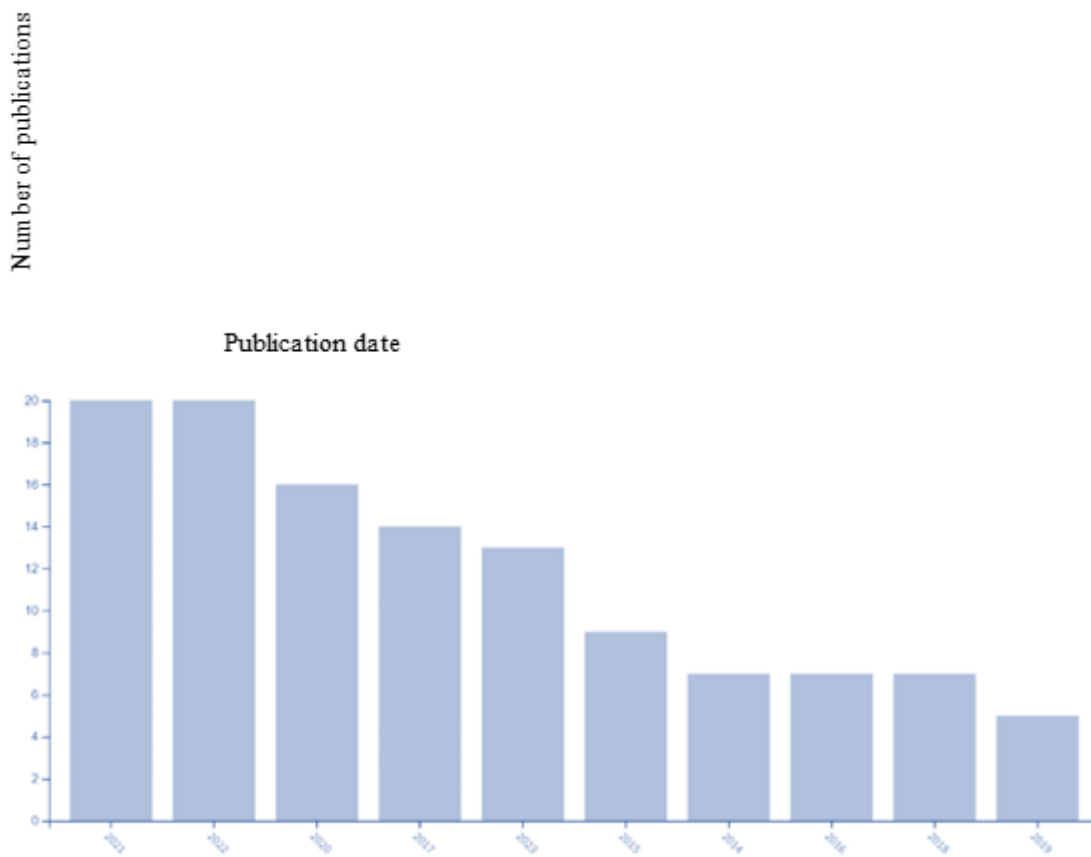


Figure 3. Distribution of publications by years

3.2. Country Analysis

Analyzing publications by country helps to understand how important the topic is in which countries. The 122 articles were produced in 33 countries in total. The United States of America (USA) has the highest number of publications with 30, followed by China with 29, and Australia with 28. It is seen that developed countries are more inclined towards this topic than developing countries (Table 1).



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Table 1. Distribution of the number of publications by country

<i>Rank</i>	<i>Country</i>	<i>Publication</i>	<i>Rank</i>	<i>Country</i>	<i>Publication</i>
	United States of America (USA)	30		Canada	7
<i>1</i>			<i>11</i>		
<i>2</i>	China	29	<i>12</i>	Spain	7
<i>3</i>	Australia	28	<i>13</i>	Turkey	7
	United Kingdom (UK)	21		Denmark	6
<i>4</i>			<i>14</i>		
<i>5</i>	Belgium	17	<i>15</i>	Norway	6
<i>6</i>	Italy	13	<i>16</i>	Germany	5
<i>7</i>	India	11	<i>17</i>	Iran	4
<i>8</i>	Switzerland	10	<i>18</i>	Sweden	4
<i>9</i>	Portugal	8	<i>19</i>	Chile	3
<i>10</i>	Austria	7	<i>20</i>	Finland	3

A study is a continuation of previous studies and each study is a part of the literature. For this reason, giving and receiving citations is a very important issue in terms of ensuring the visibility of the research in the scientific field and pioneering future studies. Figure 4 shows the top 20 most cited countries in the field. With 518 citations, it is seen that the most cited articles are from Australia.



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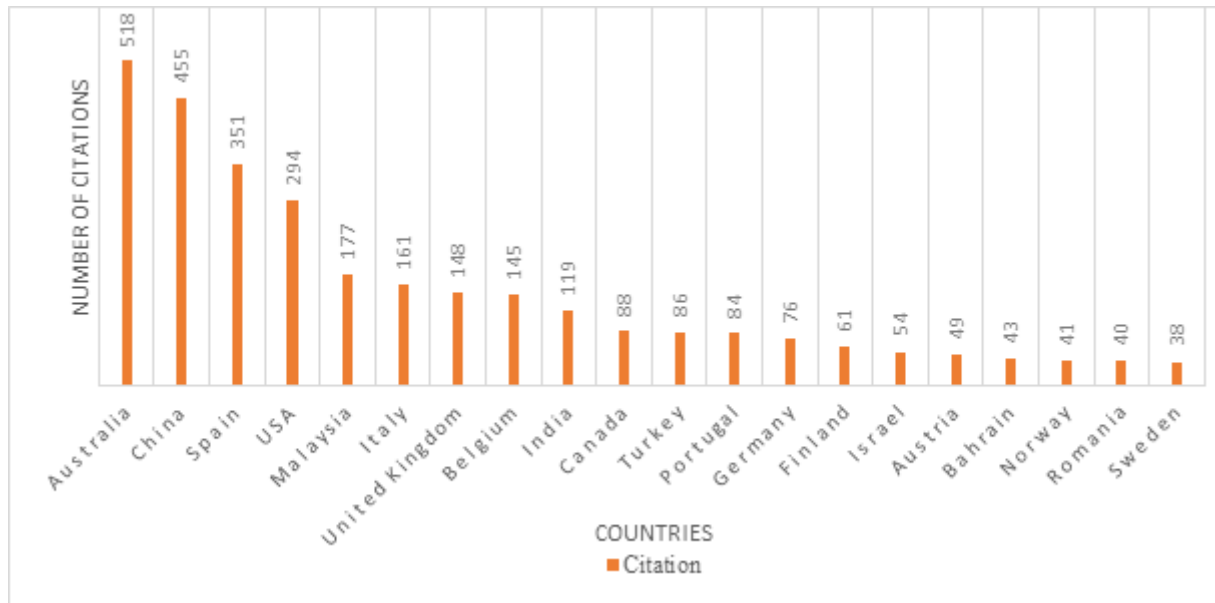


Figure 4. Top 20 most cited countries

3.3. Author and Affiliation Analysis

The citations made by authors are important not only for identifying the most influential authors but also for determining the influence of the author on other works. For this reason, universities or organizations attach great importance to publishing articles to increase their effectiveness and visibility in the scientific world. In Table 2, the list of the top 10 most highly cited authors and the organizations that produce the most articles can be seen. The top 5 most cited authors and pioneers in the field are respectively "A. Stephan" 357 citations, "R. H. Crawford" 234 citations, "A. Garcia-Martinez" 225 citations, "B. Sanchez-Montanes" 225 citations, and "A. Vilches" 225 citations. The top 3 organizations with the most publications in the Web of Science database are "University of Melbourne", "Graz University of Technology", and "KU Leuven". This data guides in assessing the importance and impact of studies in the scientific world and is an important reference for relevant researchers and institutions.

Table 2. Top 10 most cited authors and the top 10 organizations with the most publications

<i>The most cited author</i>				<i>The most productive affiliations</i>			
Rank	Author Name	Citation	H-Index	Rank	Affiliation Name	Publication	Citation
1	A. Stephan	357	6	1	University of Melbourne	11	333
2	R. H. Crawford	234	6	2	Graz University of Technology	7	61
3	A. Garcia-Martinez	225	1	3	KU Leuven	7	106
4	B. Sanchez-Montanes	225	1	4	Texas A&M University	7	52



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5	A. Vilches	225	1	5	Southeast University	5	96
6	L. Stephan	189	3	6	Technical University of Munich	4	60
7	C. H. Peng	189	2	7	University of Coimbra	4	195
8	A. F. Abd Rashid	177	1	8	Instituto de Soldadura e Qualidade	3	189
9	S. Yusoff	177	1	9	Northumbria University	3	63
10	M. Belusko	133	1	10	Norwegian University of Science and Technology	3	27

3.4. Source Analysis

Examining the top 10 platforms with the highest number of publications in the reviewed literature is necessary in terms of understanding the degree of interest of the sources in the subject. The top 3 journals with the highest number of articles are "*Energy and Buildings*" with 23 articles, "*Building and Environment*" with 12 articles, and "*Buildings*" with 10 articles (Figure 5).

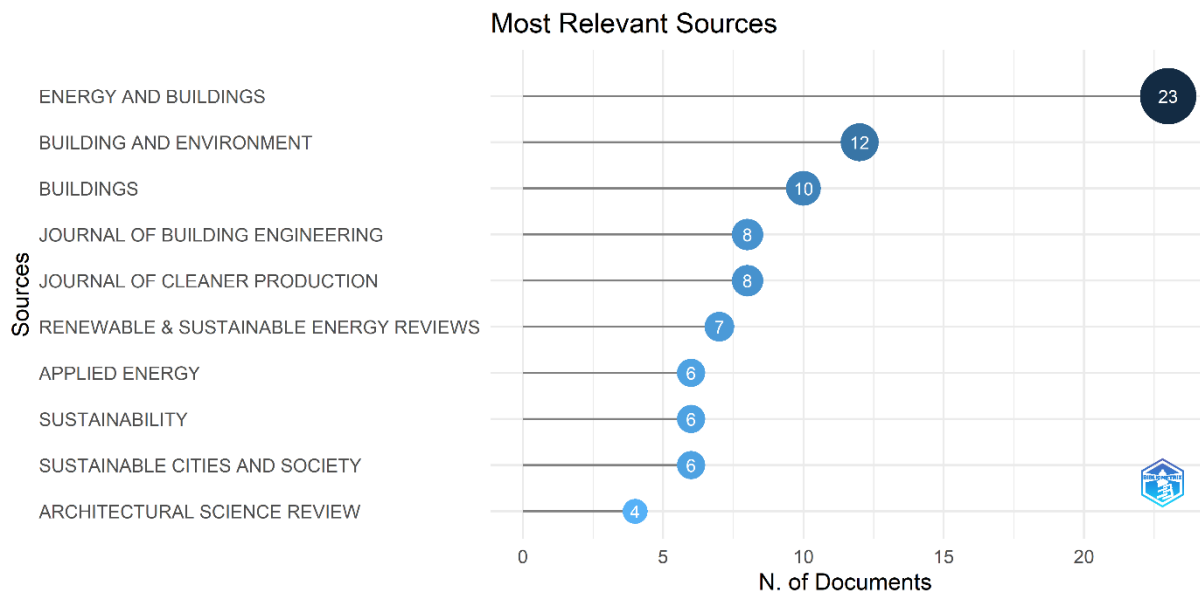


Figure 5. Top 10 sources with the highest number of publications

The three-field plot (TFP) is used to display the relationships between keywords, sources, and countries. The diagram's main characteristics are represented by rectangles of a different hue. The height of the rectangles in the TFP diagram is determined by the sum of the relationships occurring between the component of the rectangle (keywords, source, and countries) and other



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parts of the diagram. The higher the rectangle representing the component or element, the more relationship it has to other concepts it is connected to. Figure 6 depicts the TFP analysis of publications on life cycle assessment, which focuses on the relationships between keywords, sources, and countries. The graphic demonstrates the relationships between the top countries (*China, Australia, etc.*), the leading journals (*Energy and Buildings, Buildings, etc.*), and top keywords (*life cycle assessment, embodied energy, etc.*).

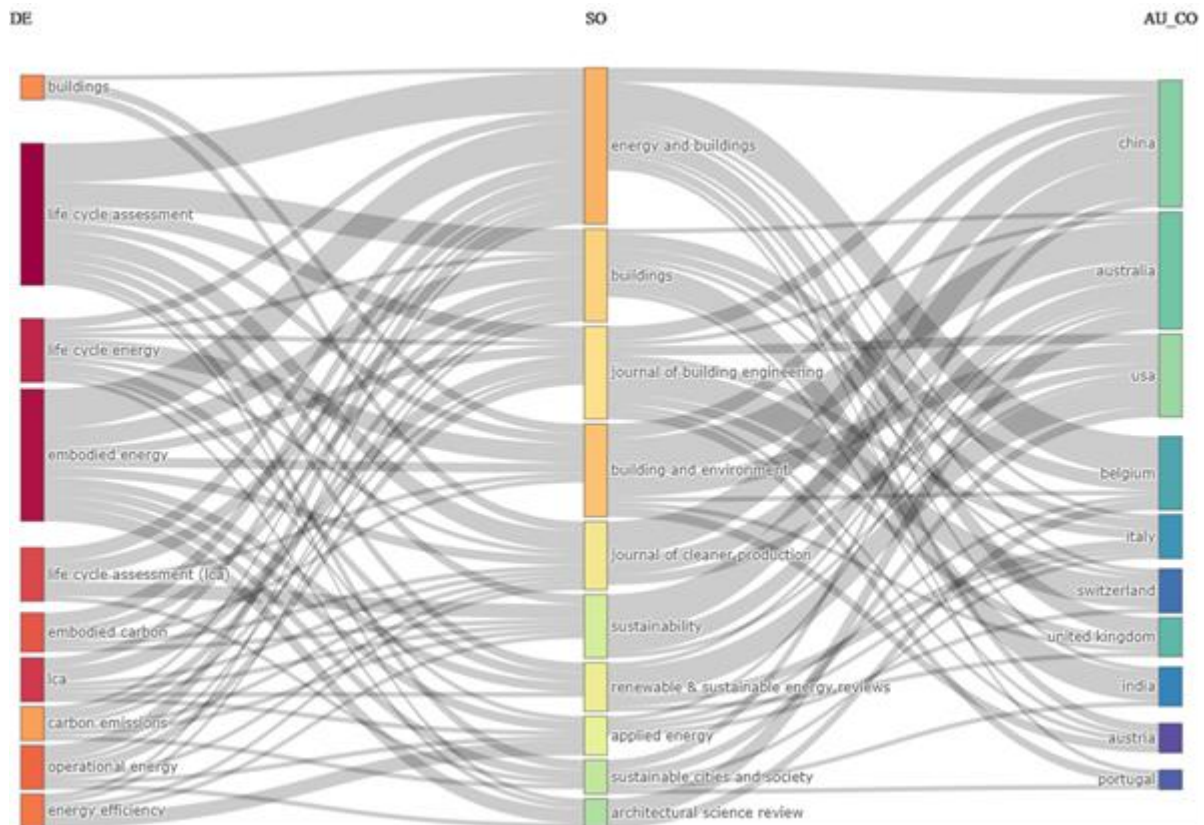


Figure 6. Relations between keywords (left), source (middle), and countries (right)

3.5. Keyword Analysis

A keyword analysis is substantial for understanding the content and scope of a study. The mapping of the keywords repeated 1 or more times is given in Figure 7. In the mapping, 396 keywords used in the publications were examined to determine the relationship, frequency, and total link strength of keywords using VOSviewer. It is seen that 2 main clusters in the keywords are formed within the framework of "life cycle assessment" indicated by the gray cluster and "embodied energy" indicated by the red cluster.



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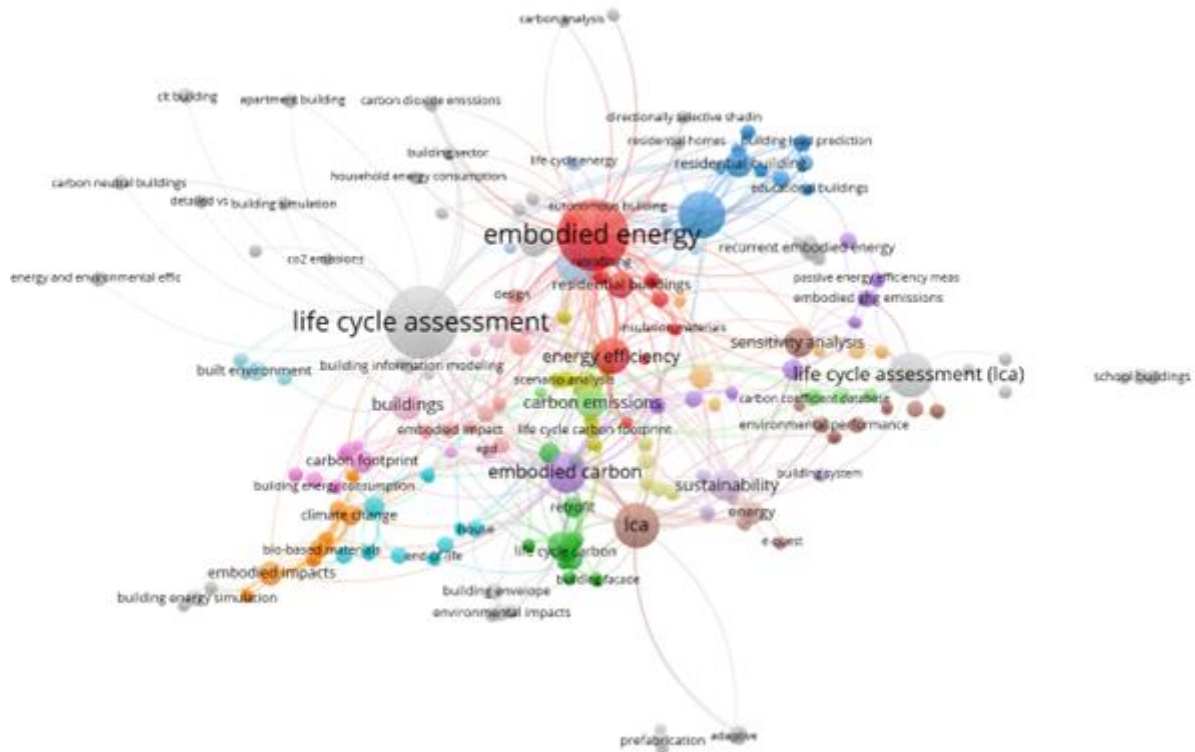


Figure 7. Keywords of the studies

3.6. Publication Analysis

In this section, content analysis was conducted to identify the prominent themes of the subject. The results were evaluated under four main themes. These themes were identified as the analyses used in the studies, building types, software & databases, and materials. Studies on life cycle assessment were conducted in different research areas such as energy, carbon, cost, climate, comfort, and design alternatives and were presented using various databases and software programs. In the second category, buildings were analyzed according to different characteristics such as type, height, size, function, renovation status, and certification status. These studies utilized a wide range of life cycle databases, BIM software, and energy simulation programs. Most of the studies were conducted at the scale of a whole building, while others focused on traditional, contemporary, prefabricated, recycled, and green building materials (Figure 8).



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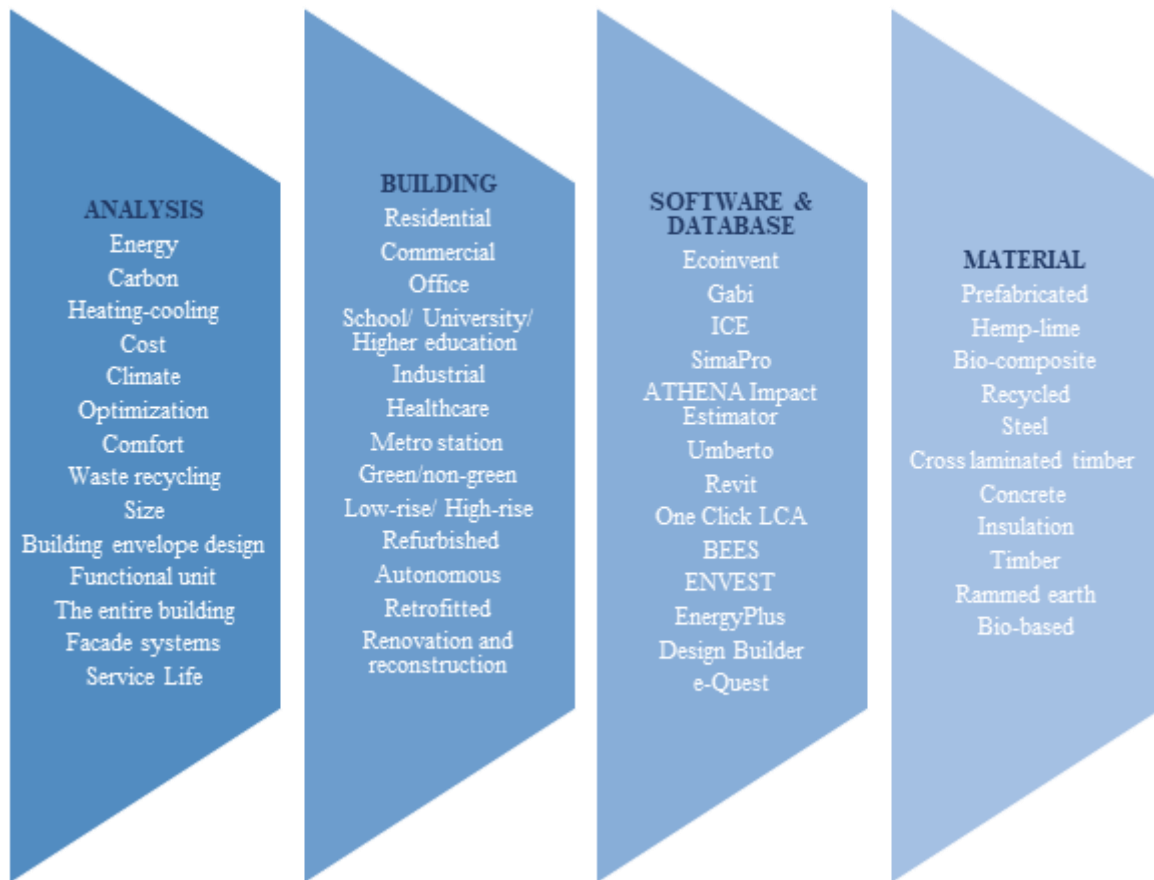


Figure 8. Trend topics of the publications

The conclusions drawn from the studies examined in detail are as follows:

- Building floor area affects the amount of recurring, total embodied energy and life cycle energy. In addition, total embodied energy may increase with the increase in the size of the house (Dixit, 2019).
- Measures to reduce operational energy are important to quantify the life cycle energy and cost over the service life of the building (Stephan & Stephan, 2016).
- Prefabricated buildings have an average embodied carbon reduction of 15%, and an average operational carbon reduction of 3.2% (Teng et al. 2018).
- Minimizing life cycle energy requires consideration of the building's embodied energy as well as heating and cooling energy. It has been determined that about 25% of the total life cycle energy of the building is due to embodied energy, especially in warm climates (Karimpour et al., 2014).
- The choice of building materials and design features affect the life cycle energy of the building (Abd Rashid & Yusoff, 2015).
- In a sensitivity analysis conducted in a study, it was found that the use phase of the building makes the largest contribution to carbon emissions (Peng, 2016).



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- In the case of building renovation, the use of new materials accounts for 10% to 60% of the total energy requirement. In renovation scenarios, the total energy requirement for the remaining life cycle of the building is reduced by 30% to 80% compared to the non-intervention case (Vilches, Garcia-Martinez, & Sanchez-Montanes, 2017).
- Life cycle assessment studies on low-rise buildings, especially on residential buildings, are numerous. However, in the life cycle assessment of high-rise buildings, commercial buildings are at the forefront (Bahramian & Yetilmezsoy, 2020).

4. CONCLUSION and RECOMMENDATIONS

The findings of this study show that research on building materials, design features, and energy use should be more focused on moving towards sustainability goals in the building sector and minimizing negative impacts on the environment. Improving buildings in terms of energy efficiency, environmental compliance, and user comfort will be an important step towards a more livable environment for future generations. Therefore, the research and studies in the building sector would contribute to raising awareness of sustainability and promoting green buildings.

In line with the results obtained, it is seen that it is necessary to adopt a holistic approach at the design stage to determine essential elements such as resource use, environmental impacts, budget, and user comfort. This comprehensive assessment will contribute to making buildings more efficient and environmentally friendly in terms of architectural sustainability.

Future studies could focus on the determinants of energy use and examine how energy consumption levels vary according to climate, building size, building height, and building age. It would also be an important area of research to examine the energy performance of different kinds of buildings in detail and make comparisons between developing and developed countries.

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**RE-FUNCTIONING FOR SUSTAINABLE CULTURAL HERITAGE:
“CENANI MANSION” INTERIOR DESIGN WORKSHOP**

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ABSTRACT

With the growth of cities, it has become inevitable for areas and structures that have lost their function in the center to transform together with their environment and gain different functions. Each of the structures with different functions in the historical surroundings of the cities is a cultural heritage as it carries the traces of the period in which they were built. For sustainable cultural heritage, the social, cultural, historical and architectural values of these structures must be preserved and thus transferred to future generations. Re-functioning in historical texture is an important area of interior design. Due to the importance of the subject, an experimental workshop was conducted with the participation of 12 students within the scope of the Interior Space Organization elective course of the Department of Architecture at Gaziantep University. This study covers the re-functioning of the Cenani Mansion, which is located in the historical city center of Gaziantep, in order to sustain its cultural heritage. At the end of the workshop, interior designs that take into account the preservation of the historical texture and the existing structure were revealed. It has been determined that the theoretical knowledge transferred to the participant students throughout the process, workshops and their own researches are reflected in the final products. With this workshop, it is aimed to gain design practices in order to think about the protection of historical buildings, which are our cultural heritage, and to function them with the right architectural solutions.

Keywords: Cultural Heritage, Sustainable Design, Refunctioning, Interior Design, Cenani Mansion.

1. INTRODUCTION

Integrating architectural heritage, which is one of the most important components of cultural heritage, with contemporary life is important for the cultural continuity of societies. Re-functioning of buildings registered as architectural heritage without compromising their identity and authenticity is one of the most preferred conservation methods today. The reuse of architectural heritage is about negotiating the transition from the past to the future to secure the historical transfer of heritage assets while also meeting the needs of the contemporary world (Chapman 2004). Considering that re-functioning rather than demolishing the building extends the life of the building (Yıldırım and Turan, 2012), the method serves the understanding of conservation in the context of both ecological and social and cultural sustainability (Tuğlu Karslı and Aytis, 2019). Ecologically, while the practice of adapting it to a new function takes into account the amount of waste that will arise during demolition, the amount of energy and materials to be consumed (Elsorady, 2013), the building, which has continued its life in a socio-cultural dimension, participates in urban life by transferring the traces of the period it was built



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to the new environmental context (Gazi and Boduroğlu, 2015). Heritage conservation, in turn, contributes to ecologically sustainable development (Pearson & Sullivan, 1999).

Re-functioning is the adaptation to a different function of historical buildings with function destroyed due to changing lifestyles over time and linked desires or the updating of historical buildings that are below standards due to continuing function but old standards of comfort. (Ahunbay 2011). "Cultural assets may be refunctioned in line with current needs, but this should be performed in a way respectful to, and without harming, the existing artistic, original, and historical features" (ICOMOS, 1965). In this reuse process, buildings must be raised to an acceptable standard of living while respecting their authenticity, integrity and meaning. (ICOMOS, 2013)

When assigning a "new function" to a structure:

- Spatial formation of the building (plan scheme)
- The volume dimensions of the building (interior dimensions of the building)
- Attention should be paid to the internal circulation of the building (Altınoluk, 1998)

In this study, the process and results of a workshop for the re-functioning of the Historical Cenani Mansion are shared. In the workshop, it was aimed for the students of Architecture to understand the practice of re-functioning in order to sustain the cultural heritage and to comprehend the methods of interior design in historical buildings. This study, which includes practices for re-functioning that should be included in architectural education practice, aims to create a document for future research.

2. MATERIALS and METHODS

For this study, Cenani Mansion located in the historical neighborhood of Gaziantep was chosen. The reasons for choosing this building are that it reflects the history and culture of the surrounding area, that it has gained many different functions from the past to the present, and that the building has been well preserved until today. In the study, literature information on the subject, the history of Cenani Mansion, the workshop process and the results of the idea projects will be shared. The workshop consists of the students' re-functioning of the Cenani mansion within the scope of the Interior Space Organization elective course of the Department of Architecture of Gaziantep University. The participants, consisting of 12 students who took the course, carried out their studies in groups of 4 people.

During the workshop, Cenani Mansion and its surroundings were visited and examined with the students. After examining the survey, restoration projects and other documents taken from KUDEB of Cenani Mansion, which is used as a cultural center by gaining a new function today, theoretical information about re-functioning was given to the students. At the end of the workshop, the function given to the historical urban texture and the original architectural structure of the mansion and the problems that may occur afterwards were questioned at the end of the workshop.



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The flow of the workshop process was followed with the table below:

↑	The importance and justifications of the concept of re-functioning in the historical environment
	Analysis of the existing historical building and its surroundings
↓	Discussion on re-functioning proposals
	Interior design of the re-functioned building
	Conclusion and evaluation

Description of Building

Cenani Mansion located between Bey and Eyüboğlu neighborhoods of Gaziantep, the southern part of Turkey, was built in 1870.



Fig. 1. Location of Cenani Mansion (Google Earth)

It is a two-storey building made of cut stone (havara stone), which consists of two courtyards and four buildings. There are shops under arched openings on the ground floor of Cenani Mansion. A round-arched door opens to the courtyard of the Mansion. There are pomegranate, apricot, mulberry, plum, apple, fig and pine trees in this large courtyard. The courtyard of the house is entered through a round arched door with a decorative keystone protruding outwards. With its triangular pediment and profiled facade windows, the building has a characteristic architectural originality.



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Fig. 2. (a) street facade of the building,

(b) courtyard of the building

The Cenani Mansion was registered on 10.03.1997 and it was donated to Gaziantep University by the Cenani family in 2010. The building, whose restoration was completed on September 30, 2011, was put into service as Gaziantep University Cenani Mansion Culture and Art Center, and serves as one of the most important culture and art centers of the city with the exhibitions and artistic events.

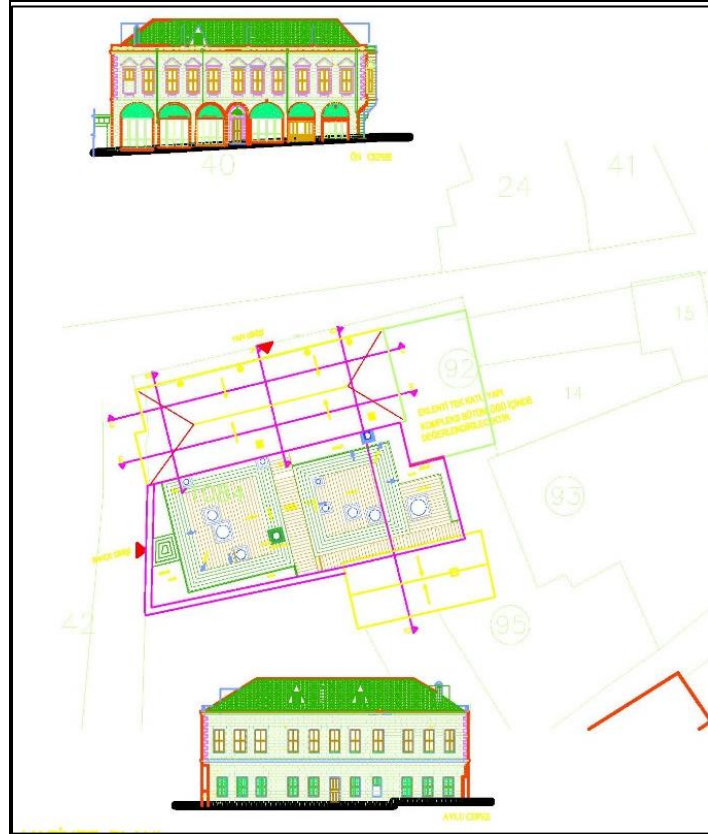


Fig. 3. Restoration project of Cenani Mansion- site plan



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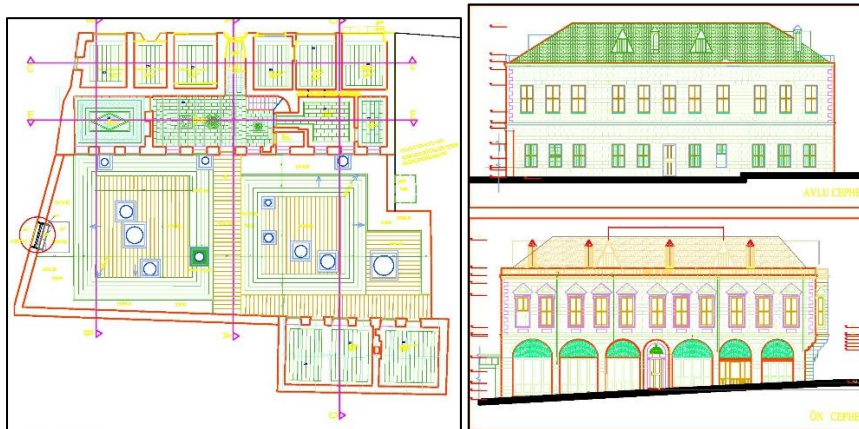


Fig. 4 Restoration project of Cenani Mansion- (a) plans (b) elevations

3. FINDINGS and DISCUSSION

Within the scope of the workshop, students were asked to propose a function for the historical Cenani Mansion and to work on the adaptation of this new function to the space. In this section, 3 proposal projects developed within the scope of the workshop are included. Each proposal consists of the work of a group of 4 people. Students presented these works with interior project expression tools (moodboard, material board, rendered plans, lighting plan, sections furniture details and 3d views).

Proposal 1: Architectural Atelier

The group that developed this proposal determined the concept of the design as the contrast of the historical texture and the new. The rationale for the new function; is the need for a place where architecture students can do their work outside of school. In the space design, the modern atmosphere of the new is reflected within the outer borders of the historical mansion. In the interior project, furniture and lighting elements were designed in line with the needs of the function.



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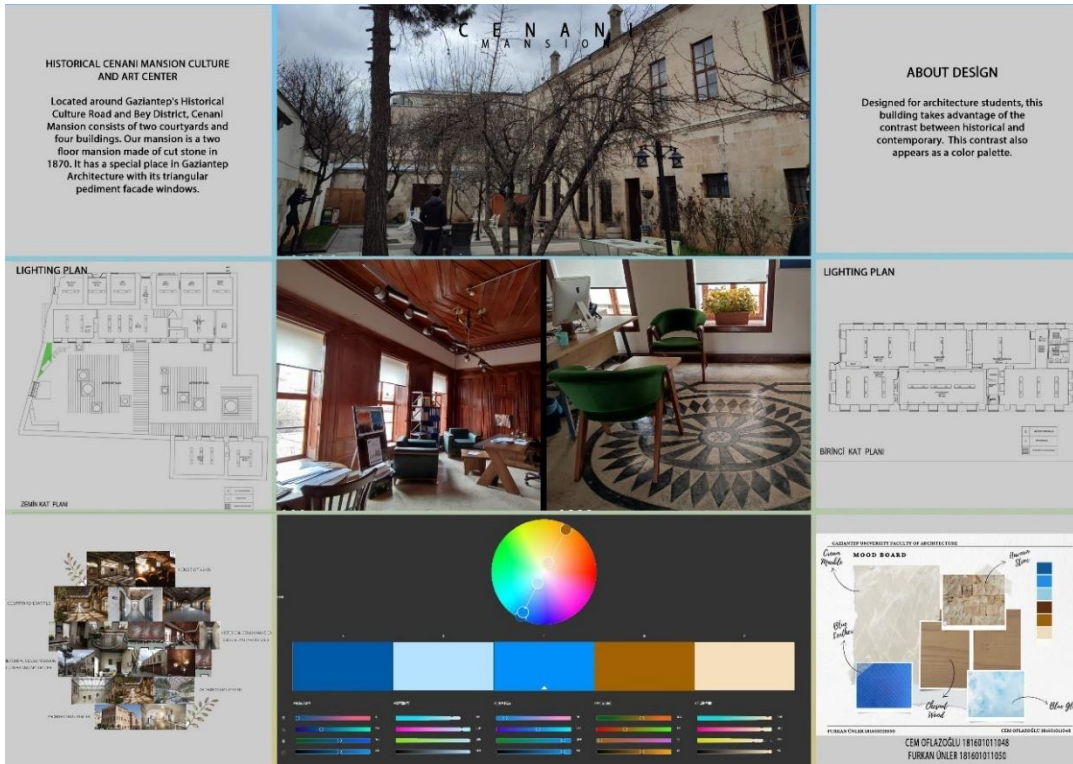


Fig 5. Proposal 1: Architectural Atelier, moodboard, material board, lighting plan



Fig 6. Proposal 1: Architectural Atelier- plans, sections, 3d views

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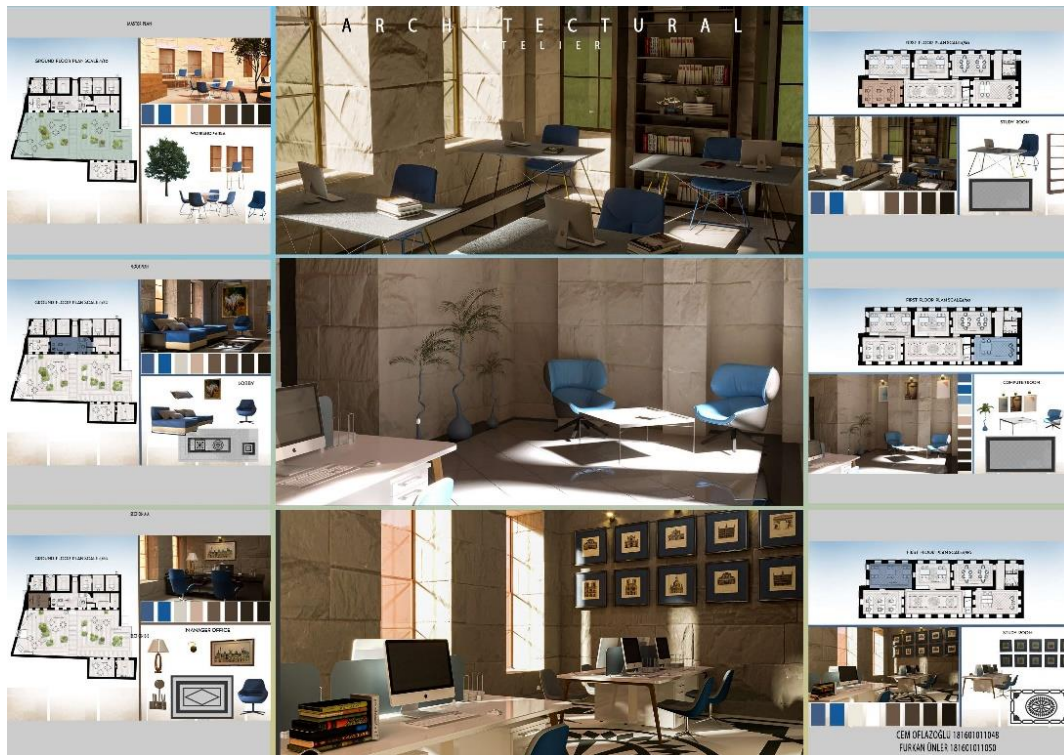


Fig 7. Proposal 1: Architectural Atelier- furniture details

Proposal 2: Boutique Hotel

The group that developed this proposal built its design concept on simplicity and comfort. The rationale for the new function; to keep the historical texture of Gaziantep alive through tourism. While commercial functions are located on the facades facing the street on the ground floor, an administrative office, kitchen and 5 hotel rooms are designed on the upper floor. There is a restaurant in the courtyard. The colors used in the design are pastel and earthy tones. Furniture for hotel room bed, nightstand, closet, etc. and the tables and chairs for the restaurant were designed by the students in a simple line.



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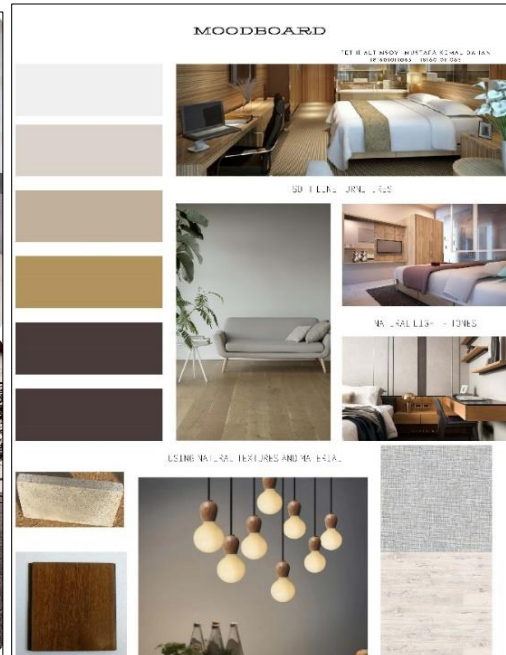


Fig 8. Proposal 2- Boutique Hotel- (a)3d view

(b) moodboard



Fig 9. Proposal 2- Boutique Hotel- (a).plans



(b). furniture details



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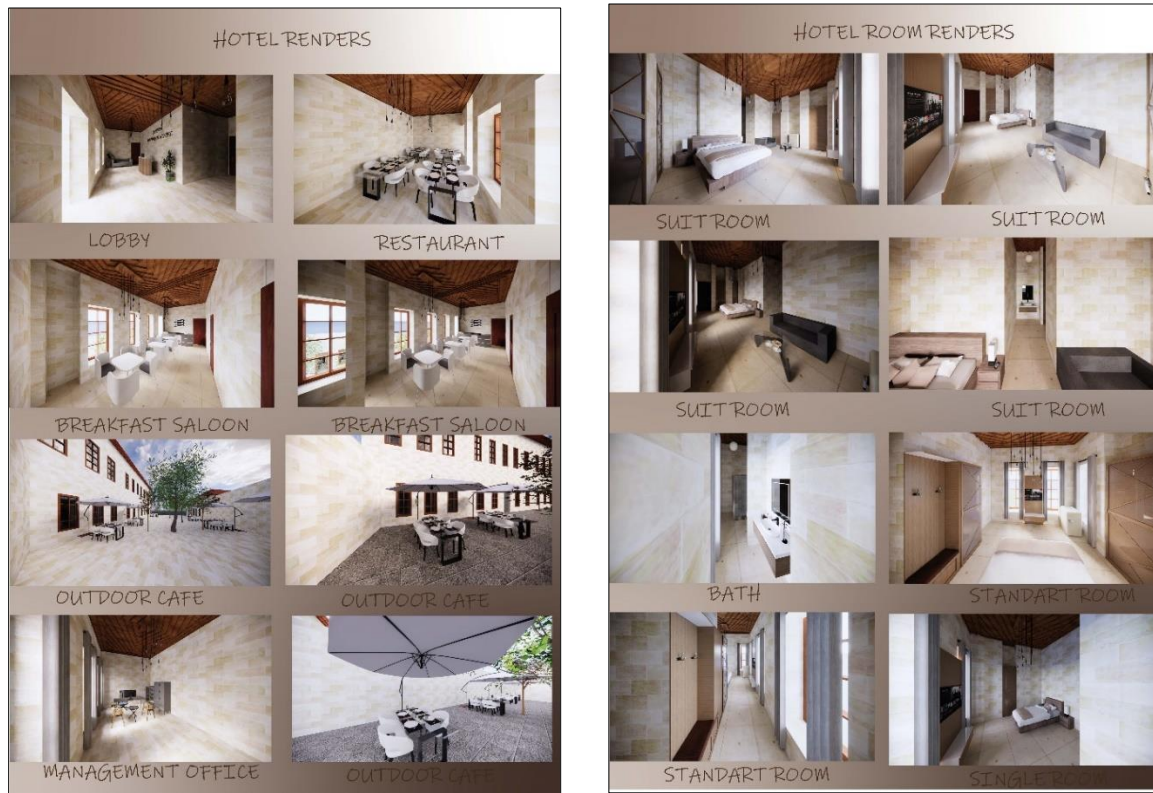


Fig. 10. Proposal 2- Boutique Hotel- 3D views

Proposal 3: Book store-cafe

The group that developed this proposal built the design concept on the principles of modernism. The rationale for the new function; It has been determined for the residents of the neighborhood where the mansion is located, for the need for the combination of book sales and cafe functions. On the ground floor, there are book sales shops on the facades facing the street, and on the upper floor, reading rooms and a group study room. There is a cafe and seating units in the courtyard. The colors used in the design are white and earth tones. The furniture is designed with clean, sharp lines reflecting the language of modernism, with metal, wood and glass materials.



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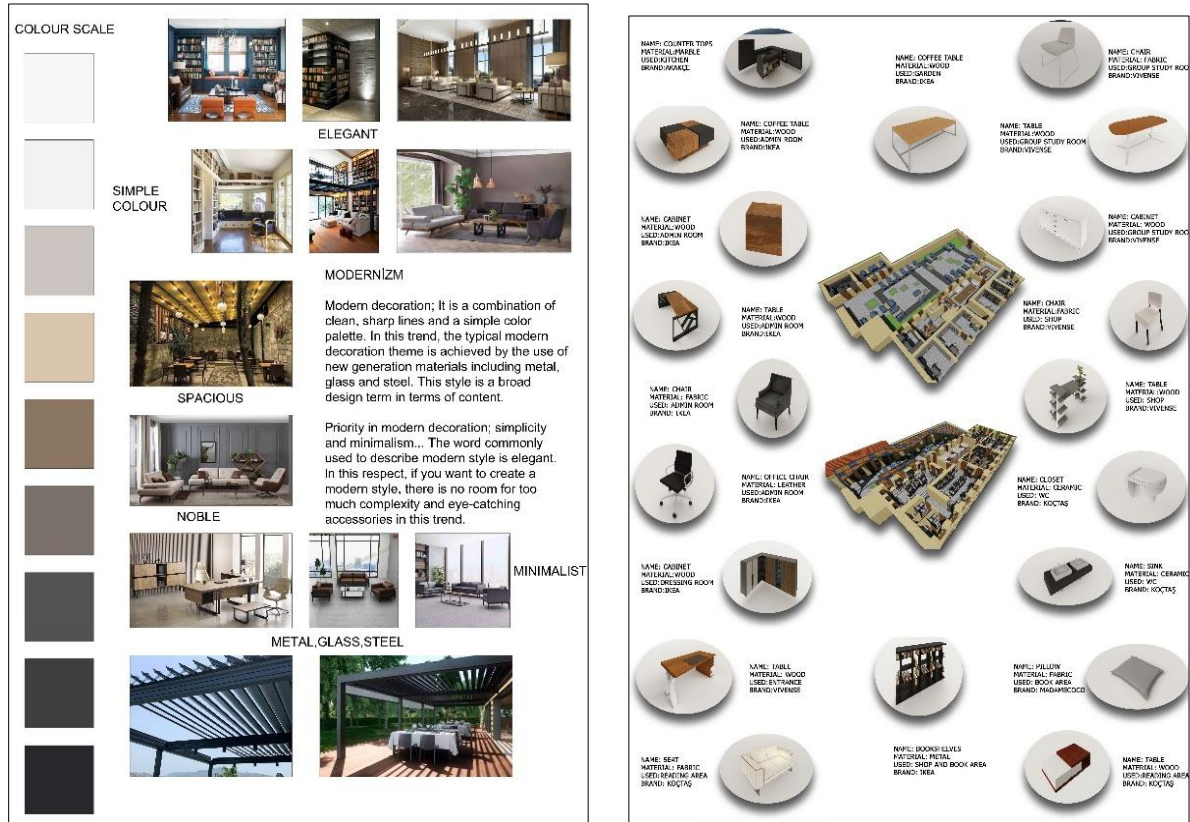


Fig. 11. Proposal 3- book store&cafe- (a) moodboard (b) materialboard



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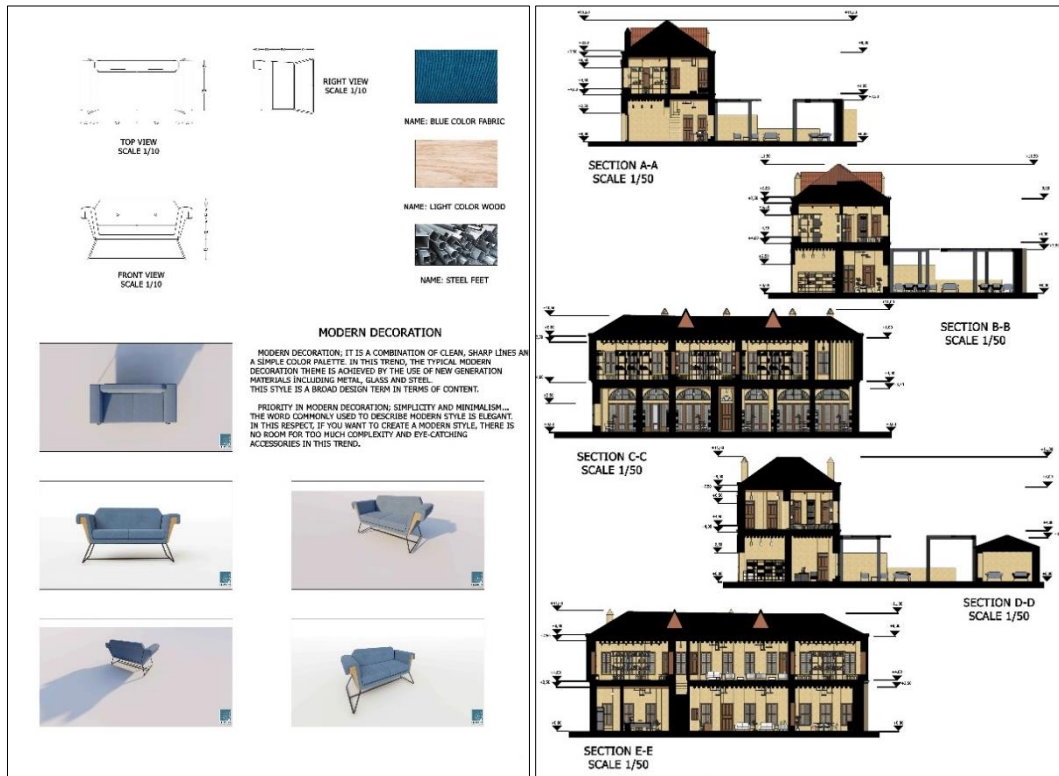


Fig. 12. Proposal 3- book store&cafe-(a) furniture details (b) sections

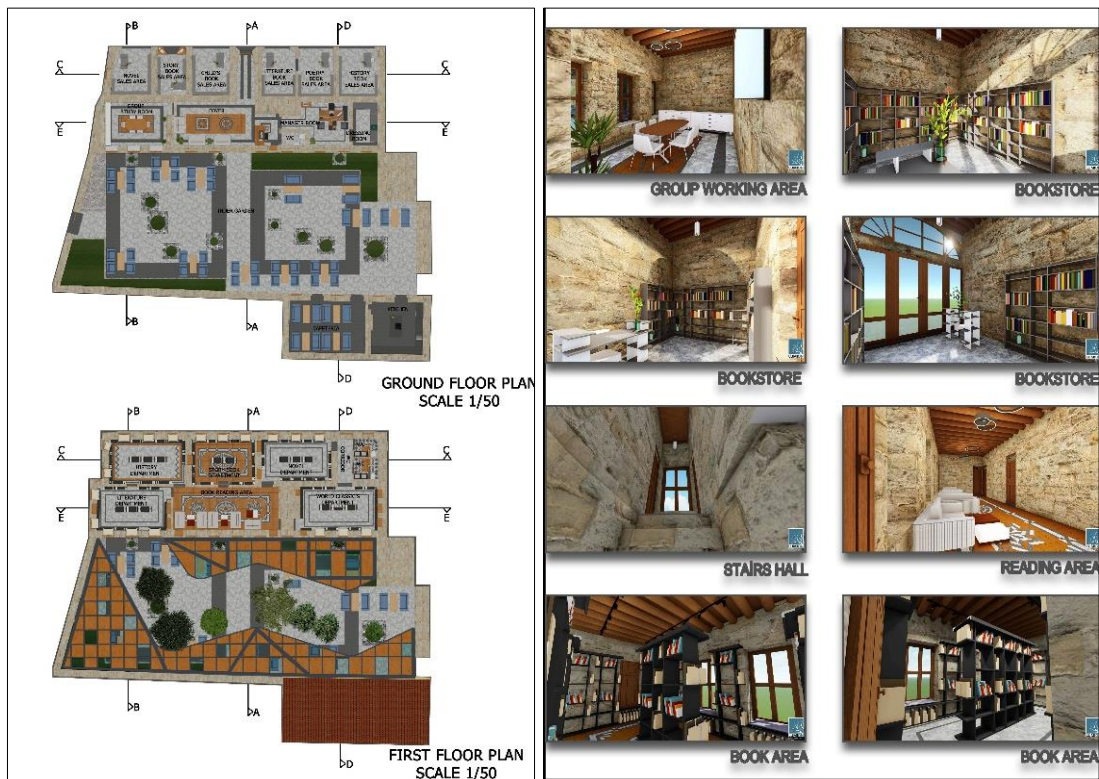


Fig. 13. Proposal 3- book store&cafe- (a) plans (b) 3d views



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4. CONCLUSION and RECOMMENDATIONS

Within the scope of the study, the workshop conducted for the re-functioning of the Cenani Mansion located in the historical Bey Mahallesi of Gaziantep city was examined. In this workshop, which was carried out with architecture students, the existing historical building was examined with visual and physical analysis, and the interior design was realized together with new functions, with three different functions being assigned. In the workshop, creating architectural solutions required by the new function by preserving the existing structural elements has been the primary criterion in ensuring the continuity of the historical texture and the social and cultural sustainability of the building.

As a result of the study, it was observed that the students had insufficient knowledge on this subject at the beginning of the workshop and the existence of innovative and creative ideas. Although the explanation of interior design through re-functioning is insufficient for the duration of the current course, it has been observed that a minimum of knowledge has been formed as a result of the theoretical information conveyed to the students during the workshop and the discussions made so that they can make original designs.

Giving students the awareness of the protection of the historical environment and buildings by practicing with different courses is important in terms of creating awareness. Since it is possible for them to encounter the problem of new building design in the historical texture in their professional life, it is certain that students who have been trained in conservation and re-functioning will make the right decisions about transmitting cultural assets to future generations.

As a result, it is inevitable that the historical and cultural environments of cities will become obsolete and function changes over time. Revitalizing historical buildings with new functions in line with the needs of the place where they are located, meeting the needs of the users and adapting them to their environment are important for the sustainability of our cultural heritage.

Note: The survey and restoration projects of Cenani Mansion have been taken from KUDEB, Gaziantep Metropolitan Municipality, Department of Conservation, Implementation and Inspection. (Fig.3 and Fig.4).

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AN ANALYSIS OF THE DOMED MOSQUES IN THE PROVINCE OF ÇANKIRI

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ABSTRACT

The dome and domed structure, one of the indispensable symbolic and functional elements of world architectural history from the earliest ages to the present day, is also one of the important building elements of Turkish-Islamic architecture. From the 14th century onwards, the Ottomans, who settled in Anatolia, started the development process of the domed space type in Anatolia by synthesizing the building culture of Islam and the Seljuks with the local materials of Anatolia and their own building culture. The domed central space is an important element of Turkish mosque architecture, and many original experiments were carried out in this direction. From the 15th century onwards, the dome ceased to be a covering element and became one of the most important symbols of Ottoman architecture. The dome architecture, which reached its most monumental form in terms of size and load-bearing system in the Classical Ottoman period, especially in the buildings designed and built by Mimar Sinan, continued to be used and diversified in the Late Ottoman and Early Republican periods. This diversity varies according to regions, localities, and time. The domes, in the construction of which various materials such as stone, brick, wood, and iron were used, were built with bagdadi technique in some of the mosques built in the 19th century and early 20th century. This study discusses some mosques in the center and districts of Çankırı Province whose domes were built with bagdadi technique. The study starts with a literature review on Çankırı. The study starts with a literature review on Çankırı. Then it continues with a literature and field study on the mosques that constitute the subject of the study. The architectural features of these buildings are emphasized and the bagdadi dome is discussed. These buildings with similar architectural features are dated to the late nineteenth century.

Keywords: Çankırı, Baghdadi Dome, Mosque, Late Ottoman Architecture.

1. INTRODUCTION

Çankırı, which is located between the Kızılırmak and the Western Black Sea basins in the north of the Central Anatolia Region, spreading over a wide area between the Ilgaz Mountains in the north and the Middle Kızılırmak Basin in the south, is a bridge connecting Central Anatolia and the Black Sea regions (Yurt Ansiklopedisi, 1982). The city of Çankırı is located in the region known as Paflagonia in history (Başer, 1956). We learn the first written information about Çankırı and the Paflagonya region in which it is located from Strabon's "Geography" in the 7th century BC (Strabon, 1993). After the 1071 Malazgirt Victory, while the raids to Anatolia continued, Suleiman Shah, the founder of the Anatolian Seljuk State, and his commanders began to capture many settlements in Anatolia. Emir Karatekin, one of the commanders of Süleyman Şah, conquered Çankırı and its surroundings in 1082-83 (Sevim, 1993). Between 1132 and 1140, due to the struggles between the Danishmendids, it changed hands several times between Byzantium and the Danishmendids (Alptekin, 1992). In 1142, during the reign of the Seljuk Sultan Mesut I, the regions of Ankara, Çankırı, Kastamonu, Kayseri, and Malatya were definitively annexed to the Anatolian Seljuk lands (Kankal, 2011). The city remained under the



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sovereignty of the Anatolian Seljuks between 1142-1243, the Cobanids for a short time until 1290, the Candarids until 1461, and then the Ottomans until the Republican period. After the city was taken over by the Ottomans, it was in Çankırı Sanjak under the Anatolian province. After the 1861 Provincial Regulation, it became a province under Kastamonu Province (Varlık, 1991). In this study, 4 mosques in Çankırı Province, which were built in the bagdadi dome technique, were examined. These are Central Şeyhoğlu Mosque, Korgun Yolcaya Village Mosque, Orta Kalfat Hatipler Mosque and Ilgaz Gaziler Village Mosque.

2. INVESTIGATION OF BAGHDADI DOMED MOSQUES IN ÇANKIRI

Bagdadi dome applications are located under a hipped roof. For this reason, it is generally defined as a hidden dome or symbolic dome. It is also referred to as "imitation dome" in some studies (Pektaş, 2013). Bagdadi technique consists of laths or slats nailed horizontally at intervals of 1-2 cm between the uprights in timber frame structures and the bagdadi plaster mortar is applied on these wooden slats and adhered to the surface by entering between them (Sözen & Tanyeli, 1986; Arseven, 1983; Hasol, 2008). In mosque architecture, the bagdadi dome appears in the simplest form as the dome placed in the center of the wooden ceiling. The dome is placed between the roof trusses and protected by a hipped roof or gable roof. The fact that the wooden material is easily accessible, lightweight, and does not bring an additional burden to the structure, provides thermal insulation by protecting it from cold and hot, and prevents dampness and humidity has made the bagdadi technique preferred in domes (Muşmak and Çetinaslan, 2009: 463).

Baghdadi domed mosques, which are the subject of this study, have a very important place among the mosques in the center and districts of Çankırı Province, most of which date back to the Ottoman period. When the mosques in the city are examined, it is seen that most of them were built with masonry adobe or stone system and have a wooden flat ceiling system. Except for the Sultan Süleyman (Ulu) Mosque and Alibey Mosque in the center of Çankırı, there are no domed mosques built in brick or stone.

Şeyhoğlu Mosque (Figure 1): The mosque has a square plan (7.50x7.60 m harim space) with a 7.60 m diameter Baghdadi dome. The dome rests on an octagonal tambour/pulley (about 150 cm tambour height) with a wooden roof covered with tiles (Figure 2). The minaret is not original and was built in 1966. Today, it is known that two wooden panels in the Archive of Dr. Rıfki Kâmil Urgan Çankırı Research Center belong to Hacışeyhoğlu Mosque. According to these inscriptions, Hacışeyhzade and Hacı Pir Said built the mosque and madrasah and Hacı Said issued a foundation in H.1268 / 1851-52. According to the gravestone in the southeast of the hazard located on the east side of the mosque, it is thought that the mosque was built before 1829-30, the date of the death of Hacı Şeyhzade Hacı Mehmet, the founder of the mosque.



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Figure 1. Exterior view of Şeyhoğlu Mosque (Karakuş, 2007)

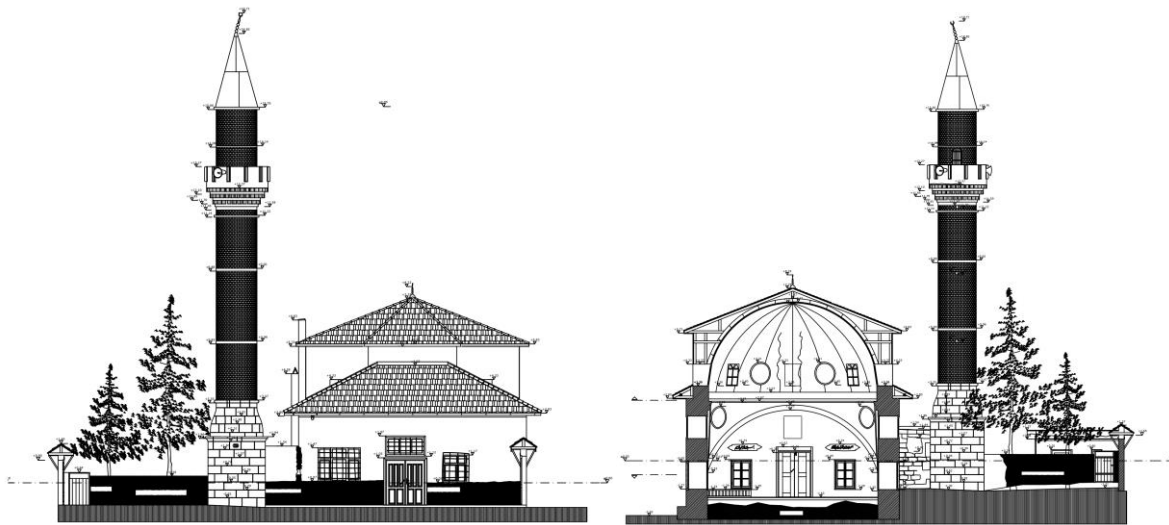


Figure 2. North façade and B-B Section (Ankara Regional Directorate of Foundations Archive)

Orta District Kalfat Hatipler Neighborhood Mosque (Figure 3): The square-plan harim (interior measures 10.14x10.08 m) of the mosque has very high main walls and the dome is supported by a polygonal pulley/tambour. There are weight towers supporting the tambour at the four corners (Figure 4-5). The walls of the harim and the tambour end at the top with profiled stone eaves that gradually open outwards. There are eight windows in the tambour. The closed last congregation area of the mosque has three sections, all of which are domed and lead coated. The transitions to the main dome are provided with squinches at the corners and the arches rest on stone consoles and are supported by tension bars at the corner. The narrow promenade at the



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base of the dome is surrounded by an iron railing. The wooden women's lounge in the north of the harim is supported by four wooden columns and the main wall. The graves of Hacı Derviş Osman, the founder of the minaret, Memişzade Ali Efendi, the founder of the mosque, and his two wives are in the courtyard. The double-balcony minaret stands slightly apart from the wall and bears traces of different periods. The minaret was built in 1858 AD. The part after the first balcony is reinforced concrete and not original.



Figure 3. Exterior and interior view of Hatipler Mosque (Karakuş, 2012)

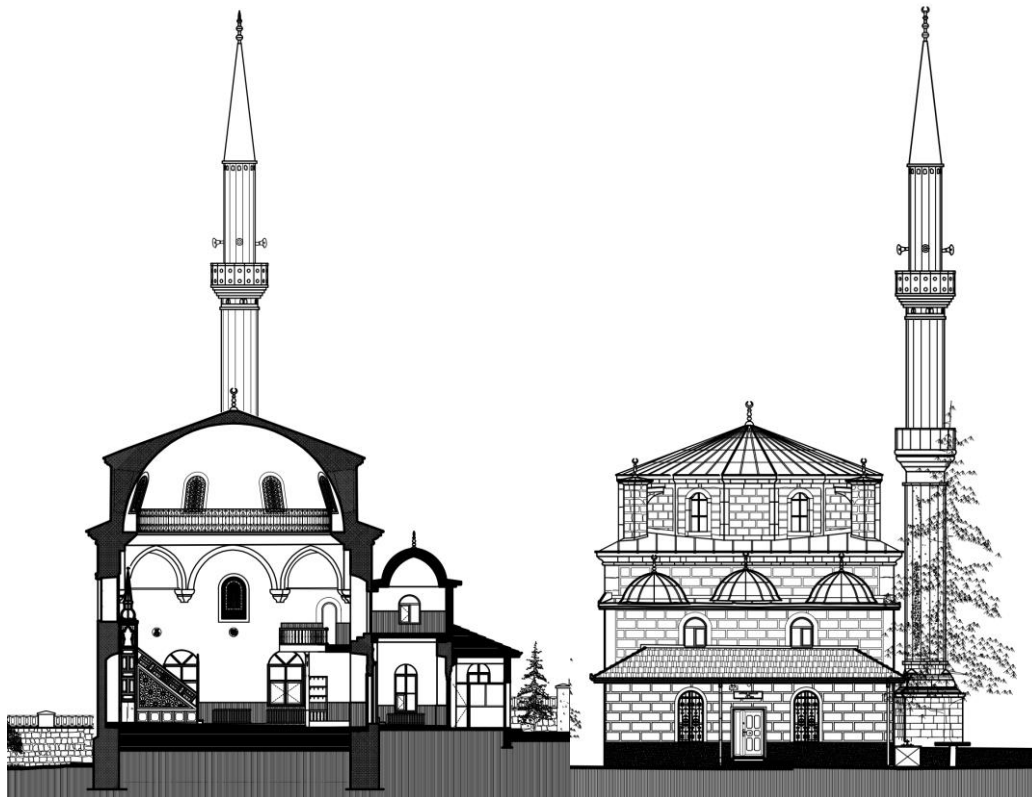


Figure 4. North façade and A-A Section (Archive of AVBB)

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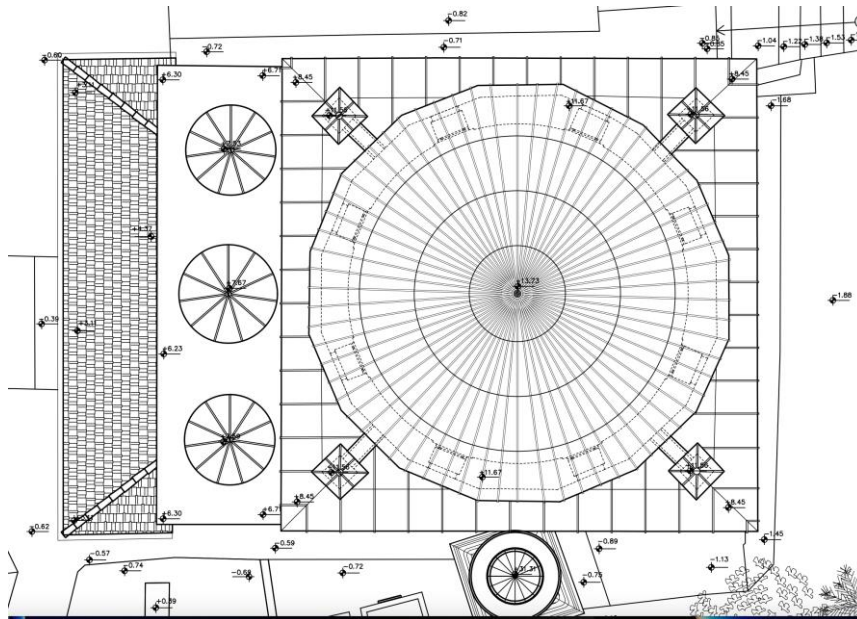


Figure 5. Plan of the dome (Archive of AVBB)

Ilgaz- Gaziler Village Mosque (Figure 6): The rectangular (10,34x12,36 m interior dimensions), two-storey building with a hipped roof was built in H.1329/M.1905. The minaret in the northwest with a single balcony was built of cut stone in 1962. There is a last congregation place open on three sides in the north. The transition to the bagdadi dome is through squinches. There are windows with revzen on the dome tambour. The dome, dome transitions, walls, arches and windows are decorated with geometric and floral motifs (Figure 7) (Ayhan, 2012).



Figure 6. Exterior and interior view of Gaziler Village Mosque (Karakuş, 2008)

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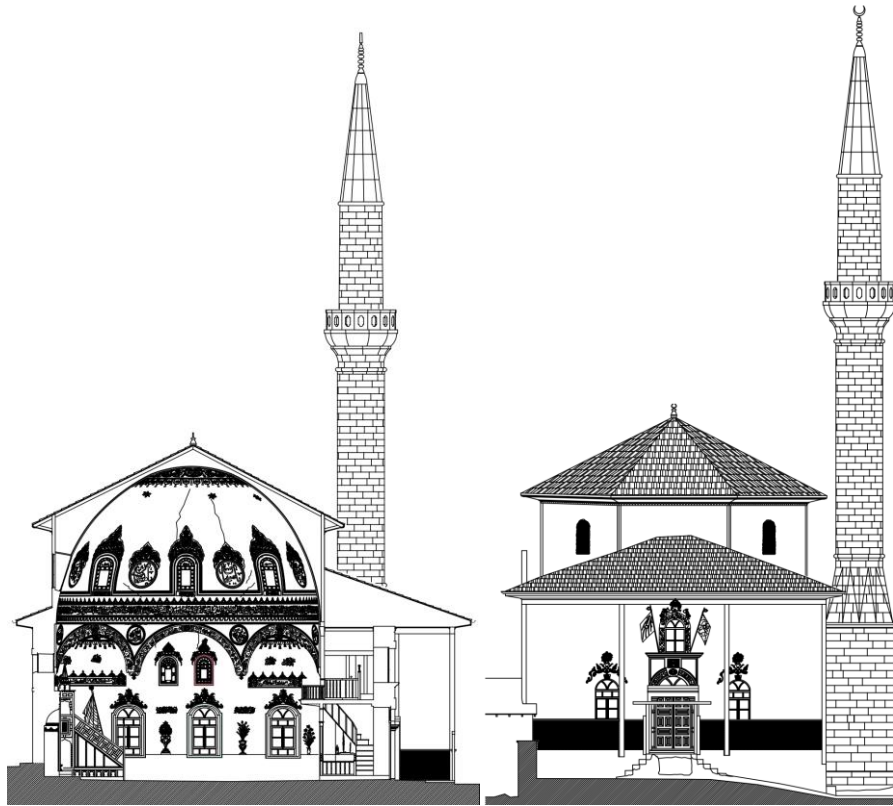


Figure 7. North façade and B-B Section (Archive of AVBB)

Korgun Yolcaya Village Mosque (Figure 8): There is no foundation registration or inscription about the construction date of the mosque. According to its architectural features and construction techniques, it is dated to the late 19th or early 20th century. The walls of the building, which has a rectangular plan scheme close to square (7,86x 7,82 m interior dimensions), are made of rubble stone. The harim space is covered by a baghdadi dome resting on an octagonal tambour/pulley. The transitions to the baghdadi dome are through pendants and the tambour is also formed by the baghdadi method (Figure 9). The smooth cut stone minaret base, adjacent to the west wall of the mosque, is adjacent to the west wall of the closed last congregation place continuing from the north.

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Figure 8. Exterior and interior view of Korgun Yolcaya Village Mosque

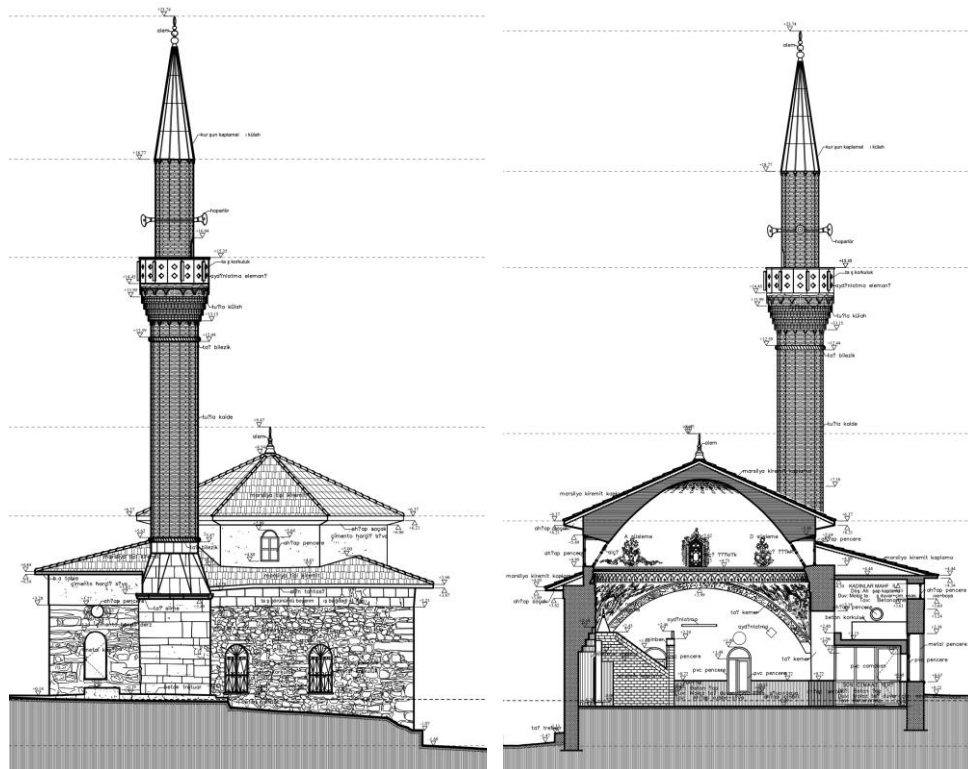


Figure 9. West façade and D-D Section

The Korgun-Mitik Mosque (Figure 10), which dates to the late Ottoman period, has rubble stone walls, a Baghdadi dome with squinches, an octagonal tambour and a tile roof. There are false arches connecting the squinches to each other. Korgun-Büyük (Old) Mosque has the same characteristics as Yolcaya Village Mosque in terms of dome features.

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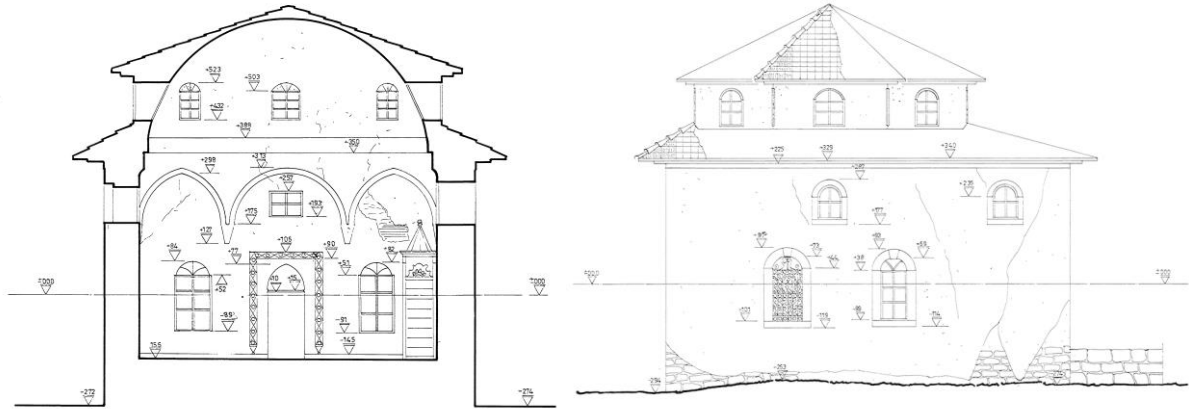


Figure 10. Korgun-Mitik Mosque B-B Section and East Façade

Kurşunlu-Şaban Ağa Mosque (Figure 11) was built in 1895. In the square-planned mosque, the baghdadi dome is placed on an octagonal tambour. The dome is decorated with hand-made floral ornamentation starting from the squinches, which are the transition elements of the dome. Korgun-Doğu Neighborhood Mosque, Yapraklı-Bugay Village Mosque and Yapraklı-Tatlı Pınar Village Mosque can also be given as examples. It is seen that these mosques also have octagonal tambours and octagonal domes with squinches as transition elements.

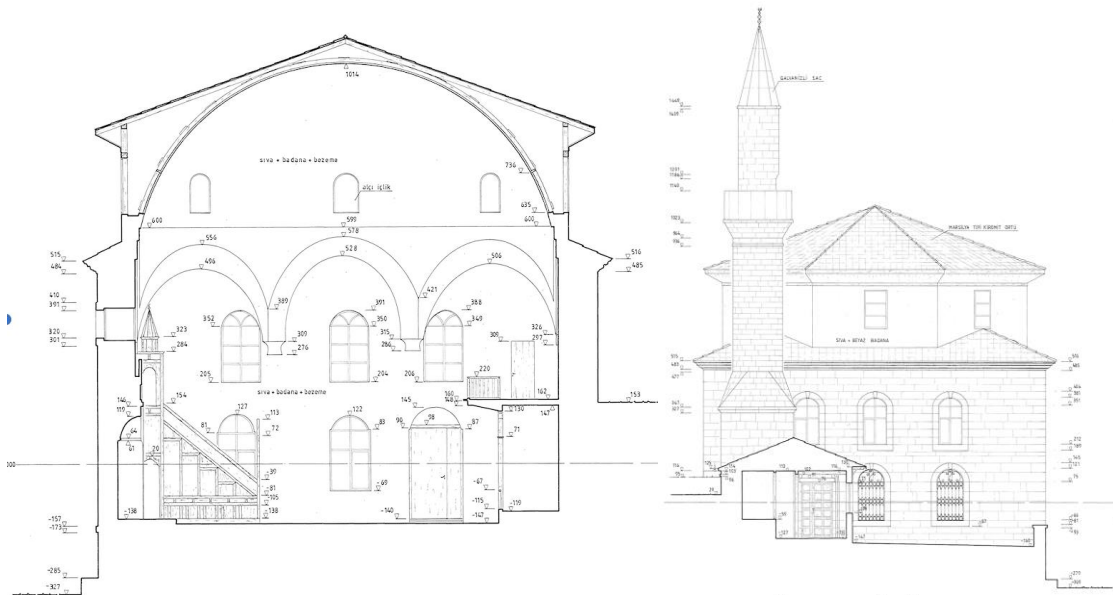


Figure 11. Kurşunlu Şaban Ağa Mosque A-A Section and East Façade

3. CONCLUSION and RECOMMENDATIONS

Within the scope of this study, the mosques with baghdadi domes in the center and districts of Çankırı, which were built in the second half of the 19th and early 20th centuries, were examined. The common point of the examined mosques is the use of rubble stone on the main walls and the application of wood in the tambura/drum and dome sections with the bağdadi technique. One of the important reasons for the use of the baghdadi dome in these buildings is that it does not bring an additional load to the structure due to the lightness of the wooden material and



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provides thermal insulation against cold and hot. In fact, the fact that domed structures are both difficult in terms of labor and more costly if they are built of stone and brick is seen as an important reason for the construction of wooden flat-roofed mosques in this region. In the domed buildings, it is seen that wooden bagdadi domes were preferred, again considering the cost and workmanship. In some of these buildings, it can be said that in the 19th century, wall decorations in baroque, rococo, and empire styles, which emerged with the influence of western art in *kalemişi* work technique, were seen.

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A STUDY ON THE DETERMINATION OF EXISTING ORNAMENTAL PLANTS AND THEIR ECOLOGICAL TOLERANCE LEVELS IN DIYARBAKIR FOREST NURSERY

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ABSTRACT

Plants in cities provide positive benefits in many areas such as regulating the urban climate, improving air quality, reducing noise, improving urban aesthetics, creating a natural environment and human health. Therefore, ornamental plants have become one of the important physical needs in urban landscaping. Today, interest in the production of ornamental plant seedlings is increasing day by day. However, nurseries should give importance to the quality of the produced seedlings rather than their quantity. Thus, the survivor rate can be increased in planting the produced seedlings. In this study, ornamental plants grown or found in Diyarbakir Forest Nursery were determined, seedling age, type and production method, the status of total seedling production and ecological tolerance levels of these plants were examined, and the opinions of nursery staff about the nursery were found out. It was revealed that the plant taxa in Diyarbakir Forest Nursery mainly consisted of 1+0 old bare-root ornamental plant seedlings and they were produced with seeding. In the nursery, the sale of forest tree species is more preferred than ornamental plants. It was found that most of the plant taxa (58%) had a moderate water consumption level. Cultural operations such as hoeing, thinning, irrigation, weeding, fertilization and transplanting are carried out in Diyarbakir Forest Nursery. In the nursery, the seedling production of plant taxa with low water consumption, natural distribution and ecologically tolerant should be preferred. This production will both increase the demand for seedlings from the nursery in landscaping in the region and will enable the plants to adapt more easily after planting.

Keywords: Forest Nursery, Ornamental Plant, Seedling Production, Diyarbakir.

1. INTRODUCTION

In today's world, buildings are being constructed without proper planning or consideration for urban values, leading to a distancing from nature and an increasing longing for it among people



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(Özdalyan, 2022). The role of ornamental plants in creating a more livable environment is becoming increasingly important. The use of plants in cities provides positive benefits in terms of urban climate, air quality, noise reduction, urban aesthetics, creating a natural environment, and human health (Taştan, 2019).

Ornamental plants, defined as decorative plants produced for aesthetic, functional, and economic purposes, are categorized into cut flowers, indoor ornamental plants, outdoor ornamental plants, and natural flower bulb cultivation (Şimşek, 2015). Ornamental plants that establish a relationship between humans and nature in urban areas have become an important physical need, and there is a great interest in ornamental plant production (Karagüzel et al., 2010). In ornamental plant production, it is important to effectively direct region-specific plants to protect natural plants and ensure sustainability (Arslan, 2022). Therefore, knowing the morphological, physiological, and genetic quality characteristics of plant species is important for selecting and using ornamental plants with desired traits, as well as understanding the ecological conditions of the landscape areas where they will be used (Kösa, 2015). In general, producing high-quality seedlings suitable for site conditions increases their lifespan in the field (Alkan & Divrik, 2019)-

Previous studies have examined the opinions of nursery managers regarding the management activities in state forest nurseries (Alkan & Divrik, 2019), evaluated the woody plant species used in urban parks in Bursa based on ecological tolerance criteria (Zencirkıran & Seyidoğlu Akdeniz, 2017), and assessed the woody plant taxa in public green areas in the city center of Ordu based on water consumption levels and ecological tolerance criteria (Güzel & Ulus, 2021). However, there is currently no research available on the identification of existing ornamental plants and their ecological tolerance levels in the Diyarbakır forest nursery.

This study aims to determine the ornamental plants grown or found in the Diyarbakır forest nursery, including the age, type, and production method of plant species, the overall seedling production status, and the ecological tolerance levels of existing plants.

2. MATERIAL and METHOD

The research area selected for the study is Diyarbakır Forest Nursery. The nursery is located in Dönümlü Mahallesi, Diyarbakır-Yenişehir District (Figure 1). The total area of the nursery is 550,000 m², with 547,960 m² dedicated to seedling cultivation, 1800 m² for seedling sales, and 240 m² for greenhouse cultivation.

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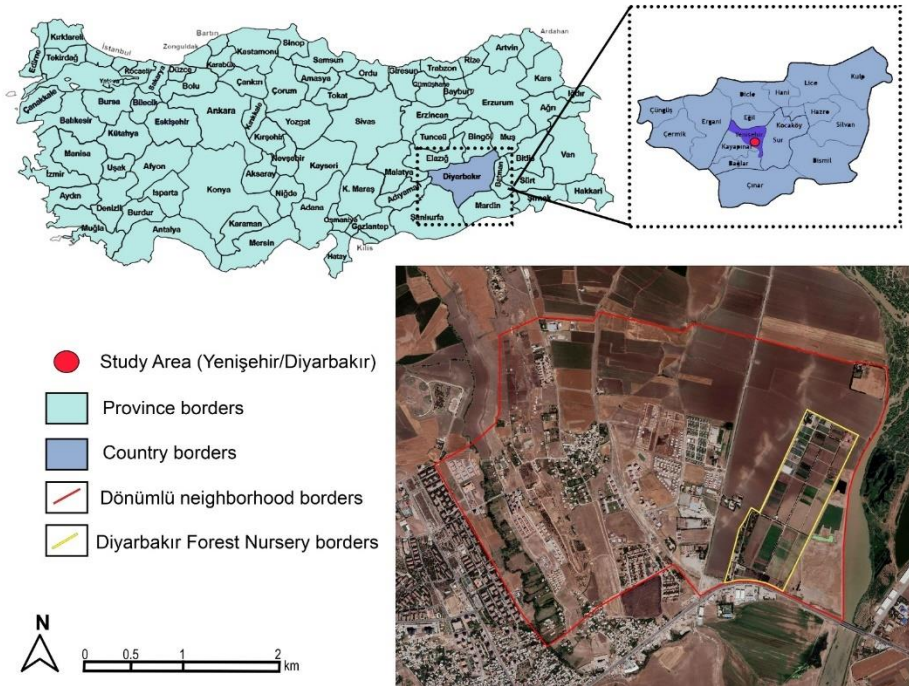


Figure 1. Location of study area

Diyarbakir province is located in the central part of Southeast Anatolia and in the northern region of Mesopotamia. It is situated at an elevation of 650 meters above sea level and 100 meters above the Tigris River (Diyarbakir Governorate, 2023). Based on 29 years of data, the average high temperature in Diyarbakir is 15.9 °C, the annual average rainfall is 493.3 mm, and the average number of days with snow cover is 13 (MGM, 2023).

In this study, the names and some information about the species grown or found in the nursery were provided by the nursery management staff. Official documents and records related to the nursery were consulted to obtain some of the information. Additionally, interviews were conducted with the nursery manager, engineers, forest conservation officers, and workers. When determining the plant taxonomy as forest trees and ornamental plants, the studies conducted by Ata (2022), OGM (2023), and Zencirkiran (2013) were referenced. The water consumption and ecological tolerance levels (tolerance to frost, heat, drought, salinity, pollution, and wind) were determined based on the studies by Zencirkiran and Akdeniz (2017) and Güzel and Ulus (2021). The ecological tolerance levels were classified into three categories: "1 = low tolerance," "2 = moderate tolerance," and "3 = high tolerance." Additionally, the plant taxonomy was grouped into five categories based on water consumption: "low," "low/medium," "medium," "medium/high," and "high" (Zencirkiran and Akdeniz, 2017).

3. RESULTS and DISCUSSION

A total of 26 taxa were identified in the study area. Out of these, 6 taxa (*Acer negundo* L., *Cupressus arizonica* L. 'Greene', *C. arizonica* L. 'Greene', *Fraxinus excelsior* L., *Platanus orientalis* L., *Pinus brutia* L.) are classified as forest trees, while 20 taxa are classified as ornamental plants. The identified taxa were further classified based on the age of the seedlings, type of seedling, and method of production. 22 taxa belong to the 1+0 age group, and 14 taxa



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are bare-root seedlings. It was determined that 17 taxa are produced from seeds. The taxa produced through cutting propagation include *Buxus sempervirens* L., *Euonymus japonica* L., *Lycium barbarum* L., *Pyracantha coccinea* M. Roem., *Rosa chinensis* L., *Rosmarinus officinalis* L., and *Thuja orientalis* cv. 'Aurea Nana' (Table 1). The cutting collection and planting are generally done in March. Rooting hormone is used during the cutting planting process.

Table 1. Age, type and production method of seedlings of plant taxa in the study area

Latin Name	Seedling age	Seedling type	Seedling production method
<i>Acer negundo</i> L.	1+0		
	1+1	Bare root	Seeding
<i>Ailanthus altissima</i> Mill.	1+2		
	1+0	Bare root	Seeding
<i>Buxus sempervirens</i> L.	1+0	Potted	Cutting
<i>Catalpa bignonioides</i> Walt.	1+0		
	1+1	Bare root	Seeding
<i>Cupressus sempervirens</i> cv. 'Pyramidalis'	1+2		
	1+0	Containerized	
	1+1	Potted	Seeding
<i>Cupressus arizonica</i> L. 'Greene'	1+2		
	1+0	Containerized	
	1+1	Potted	
	1+1	Root ball	
	1+2	Potted	Seeding
<i>Euonymus japonica</i> L.	1+3	Root ball	
	1+0	Potted	Cutting
	1+1	Bare root	Seeding
<i>Fraxinus excelsior</i> L.	1+0		
<i>Lycium barbarum</i> L.	1+0	Containerized	Cutting
<i>Juglans regia</i> L.	1+0	Bare root	
	1+0	Potted	Seeding
<i>Lavandula angustifolia</i> Mill.	1+0	Containerized	
<i>Malus floribunda</i> L.	1+2	Bare root	Purchasing
<i>Melia azedarach</i> L.	1+0		
	1+1	Bare root	Seeding
<i>Morus alba</i> L.	1+2		
	1+0	Bare root	Seeding
	1+1		



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<i>Nerium oleander</i> L.	2+0	Containerized	Seeding
<i>Pinus brutia</i> L.	1+2	Potted	Seeding
	1+0	Containerized	
		Bare root	
	1+1	Potted	
		Root ball	
<i>Pinus pumila</i> L.		Basket	Seeding
	1+2	Root ball	
		Potted	
	1+3	Basket	
		Potted	
<i>Pistacia vera</i> L.	1+0	Potted	Seeding
	1+0	Bare root	
<i>Platanus orientalis</i> L.	1+1		Seeding
	1+2	Bare root	
		Potted	
<i>Prunus dulcis</i> L.	1+0	Bare root	
		Potted	Seeding
<i>Pyracantha coccinea</i> M. Roem.	1+0	Containerized	Cutting
	1+0		
<i>Robinia pseudoacacia</i> L.	1+1	Bare root	Seeding
	1+2		
<i>Rose chinensis</i> L.	1+0	Containerized	Cutting
<i>Rosmarinus officinalis</i> L.	1+0	Containerized	Cutting
	1+0	Containerized	
<i>Thuja orientalis</i> L.	2+0	Bare root	Seeding
<i>Thuja orientalis</i> cv. 'Aurea Nana'	1+2	Potted	Cutting
		Root ball	

To overcome germination barriers of the identified taxa in the study area, hormone treatment is applied to 7 taxa, soaking in cold water is done for 4 taxa, fungicide treatment is applied to two taxa, and acid pre-treatment is done for one taxa. However, 12 taxa do not require any pre-treatment (Table 2).

Table 2. Removing germination obstacle of plant taxa in the study area

Plant taxa	Methods for removing germination obstacle
<i>Acer negundo</i> L.	No pretreatment
<i>Ailanthus altissima</i> Mill.	No pretreatment
<i>Buxus sempervirens</i> L.	Rooting hormone
<i>Catalpa bignonioides</i> Walt.	No pretreatment



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<i>Cupressus sempervirens</i> cv. 'Pyramidalis'	Soaking in cold water
<i>Cupressus arizonica</i> L. 'Greene'	Soaking in cold water
<i>Euonymus japonica</i> L.	Rooting hormone
<i>Fraxinus excelsior</i> L.	No pretreatment
<i>Lycium barbarum</i> L.	Rooting hormone
<i>Juglans regia</i> L.	Fungicide
<i>Lavandula angustifolia</i> Mill.	No pretreatment
<i>Malus floribunda</i> L.	No pretreatment
<i>Melia azedarach</i> L.	No pretreatment
<i>Morus alba</i> L.	No pretreatment
<i>Nerium oleander</i> L.	No pretreatment
<i>Pinus brutia</i> L.	Soaking in cold water
<i>Pinus pumila</i> L.	Soaking in cold water
<i>Pistacia vera</i> L.	Acid pretreatment
<i>Platanus orientalis</i> L.	No pretreatment
<i>Prunus dulcis</i> L.	Fungicide
<i>Pyracantha coccinea</i> M. Roem.	Rooting hormone
<i>Robinia pseudoacacia</i> L.	No pretreatment
<i>Rose chinensis</i> L.	Rooting hormone
<i>Rosmarinus officinalis</i> L.	Rooting hormone
<i>Thuja orientalis</i> L.	No pretreatment
<i>Thuja orientalis</i> cv. 'Aurea Nana'	Rooting hormone

When examining the production status in the last 5 years, it was determined that in 2018, 2,000,000 seedlings were produced, accounting for 15% of the total production. In 2019, 2,500,000 seedlings were produced, accounting for 19% of the total production. In the last 3 years, a total of 9,000,000 seedlings were produced, with each year producing 3,000,000 seedlings, accounting for 67% of the total production (Figure 2).

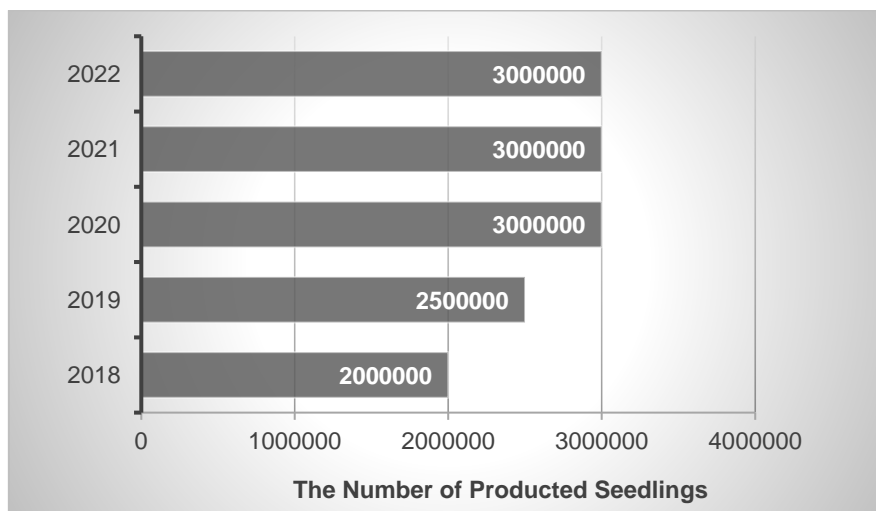


Figure 2. Seedling production in the studied nursery between 2018 and 2022



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In terms of water consumption, which is one of the essential elements for ensuring sustainability in the study area, the plant taxa with a moderate level of water consumption are found to be the highest at 58%. They are followed by plant taxa with low/medium water consumption at 19%, low water consumption at 15%, high water consumption at 8%, and medium/high water consumption at 0% (Table 3; Figure 3).

Table 3. Water consumption levels of plant taxa

Plant taxa	Water Consumption Level				
	Low (little)	Low (little)/Medium	Medium	Medium / High	High
<i>Acer negundo</i> L.			x		
<i>Ailanthus altissima</i> Mill.	x				
<i>Buxus sempervirens</i> L.			x		
<i>Catalpa bignonioides</i> Walt.			x		
<i>Cupressus sempervirens</i> cv. 'Pyramidalis'		x			
<i>Cupressus arizonica</i> L. 'Greene'	x				
<i>Euonymus japonica</i>		x			
<i>Fraxinus excelsior</i> L.					x
<i>Lycium barbarum</i> L.			x		
<i>Juglans regia</i> L.	x				
<i>Lavandula angustifolia</i> Mill.			x		
<i>Malus floribunda</i> L.			x		
<i>Melia azedarach</i> L.	x				
<i>Morus alba</i> L.			x		
<i>Nerium oleander</i> L.		x			
<i>Pinus brutia</i> L.			x		
<i>Pinus pumila</i> L.			x		
<i>Pistacia vera</i> L.		x			
<i>Platanus orientalis</i> L.			x		
<i>Prunus dulcis</i> L.			x		
<i>Pyracantha coccinea</i> M. Roem.		x			
<i>Robinia pseudoacacia</i> L.			x		
<i>Rose chinensis</i> L.					x
<i>Rosmarinus officinalis</i> L.			x		
<i>Thuja orientalis</i> L.			x		
<i>Thuja orientalis</i> cv. 'Aurea Nana'			x		

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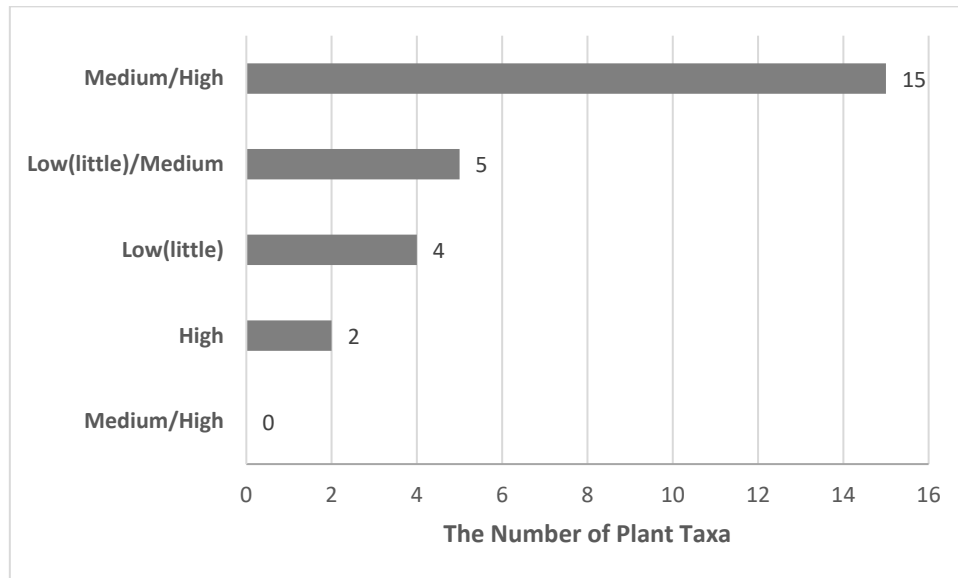


Figure 3. The number of plant taxa based on water consumption levels

Based on the evaluations conducted regarding ecological tolerance (frost, heat, drought, salt, pollution, and wind), it has been determined that 92% of the plants identified in Diyarbakır Forest Nursery are tolerant to frost. However, only 69% of the plant taxa are tolerant to heat. It was found that 73% of the plants are tolerant to drought, 50% are tolerant to salt, 88% are tolerant to pollution, and 69% are tolerant to wind (Table 4).

Table 4. Ecological tolerance level of plant taxa

Plant taxa	Ecological tolerance level																	
	Frost			Heat			Drought			Salt			Pollution			Wind		
	1*	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
<i>Acer negundo</i> L.			x	x				x			x				x	x		
<i>Ailanthus altissima</i> Mill.			x			x			x		x				x			x
<i>Buxus sempervirens</i> L.			x			x		x			x				x			x
<i>Catalpa bignonioides</i> Walt.			x	x				x			x				x			x
<i>Cupressus sempervirens</i> cv. 'Pyramidalis'			x			x			x		x				x			x
<i>Cupressus arizonica</i> L. 'Greene'			x	x					x		x				x			x
<i>Euonymus japonica</i> L.			x			x			x		x				x			x
<i>Fraxinus excelsior</i> L.			x			x	x				x				x			x
<i>Lycium barbarum</i> L.			x			x			x		x			x				x
<i>Juglans regia</i> L.			x	x					x	x					x			x
<i>Lavandula angustifolia</i> Mill.			x			x			x		x				x			x
<i>Malus floribunda</i> L.			x			x			x		x				x			x



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<i>Melia azedarach</i> L.		X	X	X	X	X	X
<i>Morus alba</i> L.		X	X	X	X	X	X
<i>Nerium oleander</i> L.		X	X	X	X	X	X
<i>Pinus brutia</i> L.		X	X	X	X	X	X
<i>Pinus pumila</i> L.		X	X	X	X	X	X
<i>Pistacia vera</i> L.	X		X	X	X	X	X
<i>Platanus orientalis</i> L.		X	X	X	X	X	X
<i>Prunus dulcis</i> L.		X	X	X	X	X	X
<i>Pyracantha coccinea</i> M. Roem.		X	X	X	X	X	X
<i>Robinia pseudoacacia</i> L.	X	X		X	X	X	X
<i>Rose chinensis</i> L.		X	X	X	X	X	X
<i>Rosmarinus officinalis</i> L.		X	X	X	X	X	X
<i>Thuja orientalis</i> L.		X	X	X	X	X	X
<i>Thuja orientalis</i> cv. 'Aurea Nana'		X	X	X	X	X	X

*1 = low tolerance, 2 = moderate tolerance, and 3 = high tolerance

In Diyarbakır Forest Nursery, various cultural practices such as hoeing, transplanting, irrigation, weeding, fertilization, and repotting are carried out. Hoeing is performed for most plant taxa (11) starting in April and continuing every month until December. Transplanting is done in June for 9 plant taxa. Irrigation is carried out every two days for 17 plant taxa, while for 9 plant taxa, it is done every four days. Weeding is performed once a month for all plant taxa, starting in April and continuing until June. Fertilization begins in June and lasts until October, with animal manure being used once a month. Fertilization is applied in conjunction with irrigation, either in the early morning or late evening, to increase water retention capacity and permeability. Repotting is done in March and November for *Cupressus sempervirens* cv. 'Pyramidalis', *C. arizonica* L. 'Greene', *Pistacia vera* L., *Platanus orientalis* L., *Thuja orientalis* L., and *T. orientalis* cv. 'Aurea Nana', while for the other taxa, it is done in March (Table 5).

Table 5. Timeline for cultural treatments of plant taxa

Plant Taxa	Cultural Treatments					
	Hoeing	Thinning	Irrigation	Wedding	Fertilization	Transplanting
<i>Acer negundo</i> L.	April	–	Once every four days	Once a month	Starting from June - Once a month	March
<i>Ailanthus altissima</i> Mill.	Starting from April - once a month	–	Once every four days	Once a month	Starting from June - Once a month	March
<i>Buxus sempervirens</i> L.	–	–	Once every four days	Once a month	Starting from June - Once a month	March
<i>Catalpa bignonioides</i> Walt.	April	–	Once every four days	Once a month	Starting from June - Once a month	March



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<i>Cupressus sempervirens</i> cv. 'Pyramidalis'	April	June	Once every two days	Once a month	Starting from June - Once a month	March - November
<i>Cupressus arizonica</i> L. 'Greene'	April	June	Once every two days	Once a month	Starting from June - Once a month	March - November
<i>Euonymus japonica</i> L.	-	-	Once every two days	Once a month	Starting from June - Once a month	March
<i>Fraxinus excelsior</i> L.	Starting from April - once a month	-	Once every four days	Once a month	Starting from June - Once a month	March
<i>Lycium barbarum</i> L.	-	-	Once every two days	Once a month	Starting from June - Once a month	March
<i>Juglans regia</i> L.	-	June	Once every two days	Once a month	Starting from June - Once a month	March
<i>Lavandula angustifolia</i> Mill.	Starting from April - once a month	-	Once every two days	Once a month	Starting from June - Once a month	March
<i>Malus floribunda</i> L.	Starting from April - once a month	-	Once every four days	Once a month	Starting from June - Once a month	March
<i>Melia azedarach</i> L.	Starting from April - once a month	-	Once every four days	Once a month	Starting from June - Once a month	March
<i>Morus alba</i> L.	Starting from April - once a month	-	Once every two days	Once a month	Starting from June - Once a month	March
<i>Nerium oleander</i> L.	-	June	Once every two days	Once a month	Starting from June - Once a month	March
<i>Pinus brutia</i> L.	Starting from April - once a month	June	Once every two days	Once a month	Starting from June - Once a month	March
<i>Pinus pumila</i> L.	Starting from April - once a month	June	Once every two days	Once a month	Starting from June - Once a month	March



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<i>Pistacia vera</i> L.	–	June	Once every two days	Once a month	Starting from June - Once a month	March - November	-
<i>Platanus orientalis</i> L.	Starting from April – once a month	–	Once every four days	Once a month	Starting from June - Once a month	March - November	-
<i>Prunus dulcis</i> L.	–	June	Once every two days	Once a month	Starting from June - Once a month	March	-
<i>Pyracantha coccinea</i> M. Roem.	–	–	Once every two days	Once a month	Starting from June - Once a month	March	-
<i>Robinia pseudoacacia</i> L.	Starting from April – once a month	–	Once every four days	Once a month	Starting from June - Once a month	March	-
<i>Rose chinensis</i> L.	–	–	Once every two days	Once a month	Starting from June - Once a month	March	-
<i>Rosmarinus officinalis</i> L.	–	–	Once every two days	Once a month	Starting from June - Once a month	March	-
<i>Thuja orientalis</i> L.	Starting from April – once a month	June	Once every two days	Once a month	Starting from June - Once a month	March - November	-
<i>Thuja orientalis</i> cv. 'Aurea Nana'	April	–	Once every two days	Once a month	Starting from June - Once a month	March - November	-

One of the biggest problems faced by the employees working in Diyarbakır Forest Nursery is that they have to do every job outside their own expertise. Therefore, they want to have a representative for each job category. Employees also face difficulties in reaching the nursery, so they state that if lodgings are provided at the nursery, both transportation problems will be solved, and they will have accommodation facilities.

The main problems related to the locations of forest nurseries include being far from the market, being far from raw materials, difficulty in finding qualified personnel, and various other issues. According to Alkan and Divrik (2019), it has been determined that forest nurseries face many problems related to their locations, such as being distant from the market, being far from raw materials, and the difficulty of finding qualified personnel. In a study conducted by Daşdemir (2017) in forest management offices, it was found that the main problems include a lack of technical, administrative, and labor status personnel to meet the needs, and there is insufficient personnel in proportion to the working area and workload.

In a survey conducted by Pak et al. (2021) among forest management chiefs and forest conservation officers in the Southeastern Anatolia Region of Turkey, it was found that the major problems were the "lack of qualified and experienced personnel" (90.1%), "low economic status of forest villagers in the region, which increases their dependency on the forest" (68.6%), and



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"employees facing political pressure while performing their duties" (82.3%). In another survey conducted by Pak et al. (2022) on job descriptions in the Kahramanmaraş Forest Regional Directorate, 54.8% had negative opinions about employee shortages, while 42.9% had positive opinions. These studies reveal that there are problems with job descriptions both in forest nurseries and forest management offices.

According to the personnel surveyed in the study, Diyarbakır Forest Nursery holds a significant place in the market for both ornamental plants and forest tree seedlings in the Southeastern Anatolia Region, but they emphasize that they give more importance to the production of forest tree seedlings, and the majority of their sales consist of forest tree seedlings. Although Diyarbakır Forest Nursery does not have a market problem, a study by Divrik (2019) found that 60.8% of nursery managers were not at the desired level in terms of marketing. This difference may be due to the regional variability in the market conditions of forest nurseries.

It is believed that participating in different activities and conducting advertisements for the promotion of the forest nursery can greatly benefit tree seedling sales. Free distribution of seedlings to schools on special days like Forestry Week is done to instill a love for trees and forests in the public. In addition, promotional activities for seedlings are carried out by creating public service announcements. Such activities or promotions are considered important for raising awareness and development of the public. Similarly, in a study by Divrik (2019), 89.3% of nursery directorates agreed that pages on social media platforms like Facebook and Twitter contributed to promotion.

According to the information obtained from the nursery director, they mostly produce their own seedlings. In case of any need, they obtain the necessary seedlings from other nurseries affiliated with the directorate.

4. CONCLUSION and SUGGESTIONS

Like many other places in the world, the ornamental plant industry is also popular in Turkey. Therefore, both private and state enterprises engage in ornamental plant production on a regional basis. Given the potential to create alternative employment opportunities, these ornamental plant production enterprises should be valued and emphasized. To achieve this goal, it is crucial to identify the production potential as well as the demand and problems of these enterprises.

In this study, it has been revealed that the plant stock in Diyarbakır Forest Nursery primarily consists of 1+0-year-old bare-rooted ornamental plant seedlings, which are produced from seeds. However, the sale of forest trees is preferred more. It is necessary to conduct more comprehensive cultural practices and monitoring of the plant stock. The majority of the plant stock (58%) was found to have a moderate level of water consumption. Therefore, it is preferable to produce plant stock with low water consumption levels that are naturally distributed in the region and tolerant to ecological conditions. The production of tolerant plant stock will increase the demand for plants from the nursery in landscaping applications in the region and play an important role in the easier adaptation of plants after planting.

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**USE OF PARKS BY DISADVANTAGED INDIVIDUALS: CASE OF ANTALYA-
DOKUMAPARK, TÜRKIYE**

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ABSTRACT

Open green spaces in and around the city are important places where people meet their needs such as resting and socializing. One of these important public spaces is parks. In this context, it is of great importance that the parks are accessible to everyone. In this study, Dokumapark in Antalya was examined in terms of the unrestricted movement of disadvantaged individuals in the park and their accessibility to various furniture. For this purpose, observation and detection method was used. Although the width of the walking paths in Dokumapark are in accordance with the standards, the inadequacy of the floor materials restricts the movements of the disadvantaged individuals. In addition, there are no tactile ground surfaces and walking lanes for visually impaired individuals on the roads in the park. There is a total of 219 parking spaces in the park, 6 of which are reserved for the disabled, but this does not comply with the rate specified in the parking regulation. The dimensions of the seating elements in the park are sufficient. There is not enough space for wheelchairs around the table. The heights of the garbage cans do not comply with the standard height dimensions. In addition, the locations of the furniture for the visually impaired are not specified with the necessary texture or color difference applications. For more effective use of Dokumapark by disadvantaged individuals, re-planning and design works should be carried out in the park by taking into account the results of the present study. Thus, it will improve the wellbeing of those who are less fortunate and their level of societal integration. In future studies, more comprehensive results can be obtained by conducting interviews with disadvantaged individuals in Dokumapark.

Keywords: Disadvantaged Individual, Dokumapark, Furniture, Accessibility.

1. INTRODUCTION

Parks are important spaces that provide various benefits to cities and their residents (Toomey et al., 2020). Considered as expansive green areas in densely urbanized regions, parks are among the most popular and frequently visited public spaces by users (Polko & Kimic, 2021). In addition to offering environmental and social services as well as recreational opportunities,



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these areas also enhance the aesthetic appeal of urban environments (Konijnendijk et al., 2013; Nowak et al., 2018; Schnell et al., 2019). Furthermore, as parks are often viewed as the lungs of the city, they also support the structures in residential areas (Jim & Chen, 2006).

The term "disadvantaged" is comprehensive and flexible. In this study, it is considered to encompass elderly individuals, parents with baby strollers, pregnant women, visually and mobility impaired individuals, as well as wheelchair users. Planning and designing park areas with the ease of use for these individuals in mind is of utmost importance. This way, these individuals will be able to use these spaces easily during their leisure time and greatly enhance their social interaction.

Despite previous studies (Akgün Pişkin, 2021; Belkayalı & Güloğlu, 2019; Buğra Tekinalp & Birol Özerk, 2015; Çetişli-Korkmaz et al., 2021; Güngör, 2016; Güngör et al., 2016; Kurşun, 2014; Olgun & Yılmaz, 2014; Stanton-Chapman & Schmidt, 2018; Tarhuni, 2022) indicating that parks are not very suitable for the use of disabled individuals, the number of studies aimed at enabling these individuals to use parks seamlessly remains inadequate.

In this study, the aim is to assess the suitability of Antalya's Dokumapark for use by disadvantaged individuals.

2. MATERIAL and METHOD

In this research, Dokumapark located in the Antalya province of Turkey was chosen as the study area (Figure 1). The park is approximately 5 km away from the city center of Antalya. It was named Dokumapark in 2009 and was opened in 2015, covering an area of 238,000 square meters, which includes green spaces, a cafeteria, and sports facilities. There is a total of 116,000 square meters of green area in the study area. Dokumapark is considered one of the attraction centers of Antalya (Anonymous, 2023).

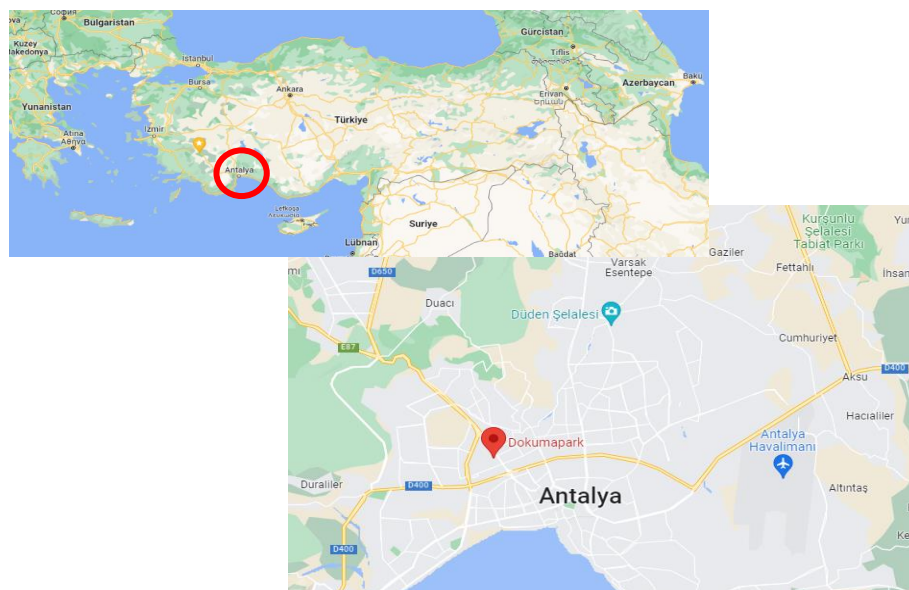


Figure 1. Location of study area

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In this study, an observation and assessment method were utilized. Data related to the park entrance, walking trials, parking lots, as well as urban and social furnitures within the study area were collected and evaluated according to standards for individuals with disabilities. Additionally, the findings of the study were supported with photographs.

3. RESULTS and DISCUSSION

a. Park Entrances

The study area has a total of 5 entrance points, providing access from various directions. The area is enclosed by walls, and there are no vehicle entrances; only pedestrian entrances are available. The width measurements of the entrances are sufficient according to user density (Figure 2).

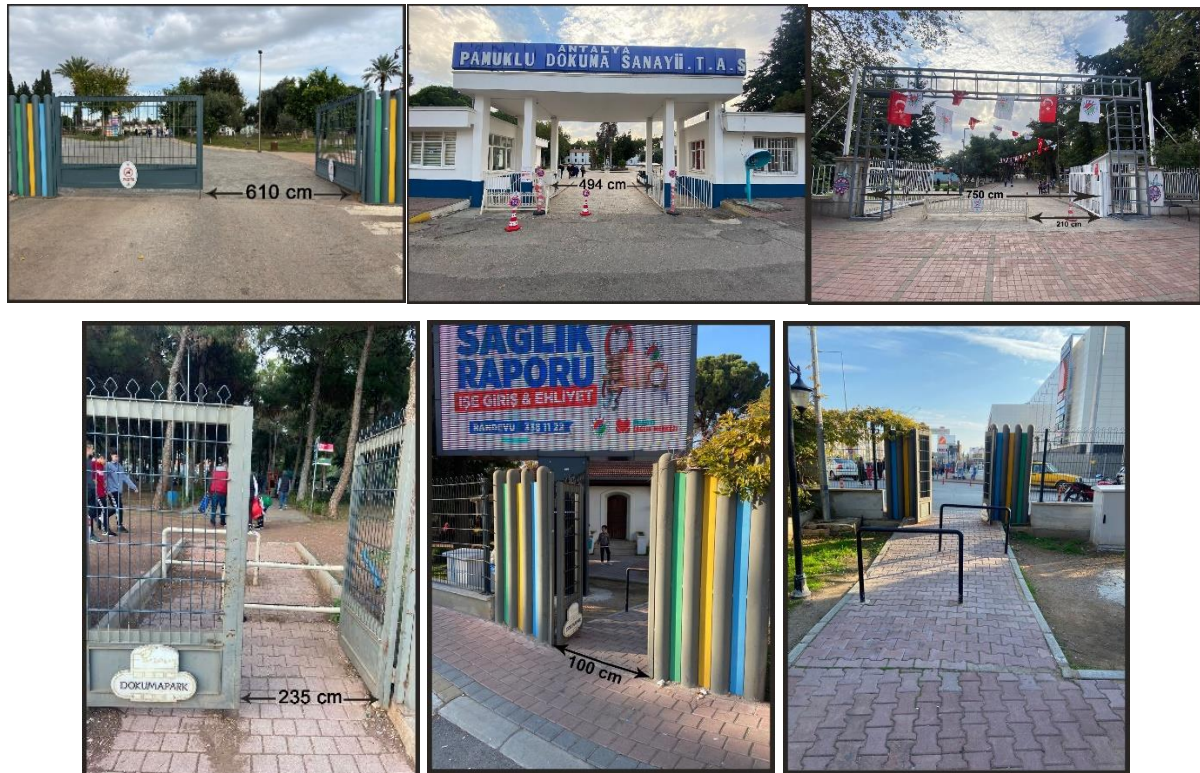


Figure 2. Dokumapark entrances

b. Walking trials

To ensure that disadvantaged individuals can move freely and without encountering any obstacles on the walking trials, there should be no obstructions along the path route. Unsuitable grates, irregularities, differences in elevation, etc., should all be avoided (Gökçe, 2012). Pedestrian path pavements should be slip-resistant and designed to facilitate movement. Elements such as steps and drain covers should not protrude, and there should be no sudden changes in levels. The trials should be continuous and at the same level (TSE, 1999).

According to the criteria specified in TS 12576 (1999), pedestrian pathways/sidewalks should have a minimum width of 150 cm to allow two wheelchairs to pass each other comfortably (UN, 2004). According to these standards, the widths of the walking trials within the study area are suitable for the use of disadvantaged groups (Figure 3).

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In the area, cobblestone and soil have been used as paving materials for the walking trials. The lighting fixtures, trash bins, directional signs, etc., along the trials do not have detectable surface elements or contrasting textures or colors, which can be a hazard for visually impaired individuals. Additionally, there are no arrangements in place on the walking trials within the park to provide route guidance for visually impaired individuals (Figure 3).



Figure 3. Some walking trials in Dokumapark

The path shown in Figure 4, which does not conform to the width standard and other criteria, poses restrictions on the use of individuals with baby strollers, visual impairments, and mobility impairments. In this context, considering the fact that removing obstacles increases communication between disabled and non-disabled individuals, it is necessary to design and plan accessible and usable systems for disabled individuals (Koramaz & Küçükali, 2021).



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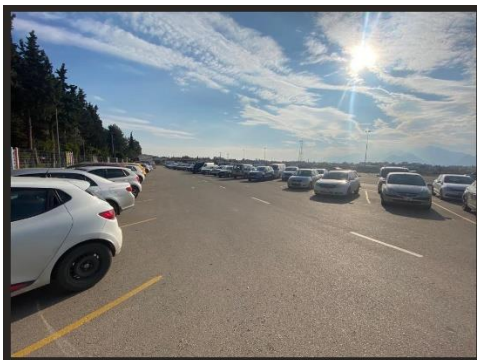
Figure 4. Improper walking trials in Dokumapark

c. Parking lots

According to the parking regulations (2022), it is mandatory that one out of every 10 parking spaces be designated for disabled individuals with an appropriate disabled marking. These spaces should be located closest to the entrances, exits, and elevators of public buildings, regional parking lots, and general parking lots. The long side of a single parking space should be at least 4.90 meters, and the short side should be a minimum of 3.50 meters (Presidential Legislation Information System, 2022).

In general parking lots, there should be a visible and easily readable disabled sign indicating that disabled individuals can park there. Additionally, directional signs leading disabled individuals to their parking spaces within the facility and a disabled parking symbol on the ground, wall, or suspended from the ceiling in open parking spaces should be installed. In closed parking facilities, road signs should be illuminated at night (ÖZİDA, 2011).

In the study lots, there is one open parking lots (Figure 5). Within this lots, there are a total of 219 parking spaces, of which 6 are designated for disabled individuals with appropriate disabled markings. This number does not conform to the ratio specified in the parking regulations. The parking spaces designated for disabled individuals are located close to the entrance gate. The night lighting in the parking lots is sufficient. Asphalt is used as the paving material for the parking lots, and parking spaces are delineated with lines. There are directional signs indicating the entrance and exit of the parking lots.



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Figure 5. Parking lot in Dokumapark

d. Urban furniture

Seating elements

According to the criteria of the United Nations (UN) in 2004, rest areas with seating benches should have a clear space of 1.2 meters next to them for wheelchairs (Figure 6a). The height of the bench from the ground should be 45 cm, and the height of the backrest should be 70 cm (Figure 6b). To allow access from all sides for wheelchairs, the height of tables should be between 75 and 90 cm, with a minimum depth of 60 cm under the table (Figure 6c).

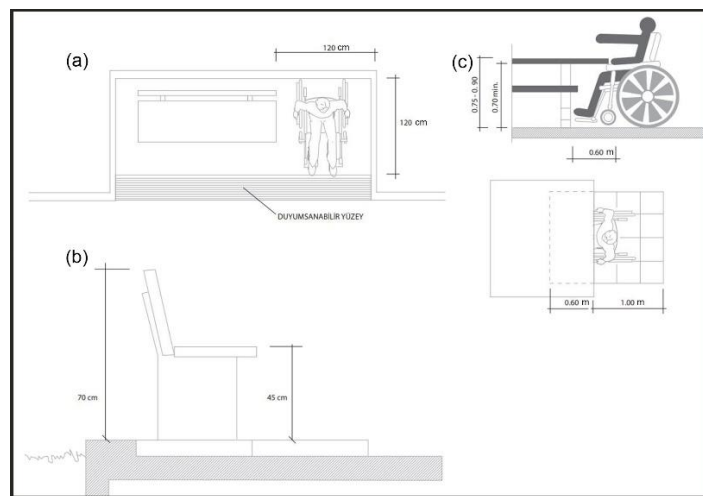
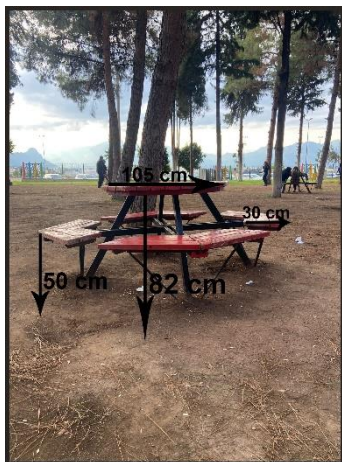


Figure 6. Design of seating fronts (a), Height of sitting bench (b), Sizes of tables in resting areas (c) (BM, 2004)

Most of the seating units within the area are of sufficient size. However, there is insufficient space at the edges of the tables for wheelchairs (Figure 7).



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Figure 7. Seating elements in Dokumapark

Trash cans

Trash bins should be positioned along pedestrian sidewalks, at least 40 cm away from the curb, and at a height of 90-120 cm, in a way that does not obstruct pedestrian movement (TS 12576, 1999) (Figure 8).

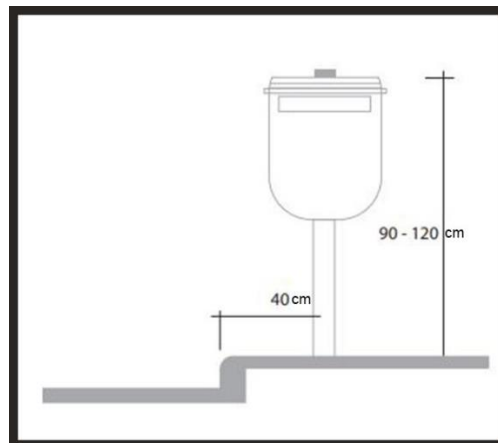


Figure 8. Standard measures of trash bin (TS 12576, 1999)

The positioning of the trash bins within the study area, being located at the boundaries of the walking paths and fixed to the ground, is restrictive to user movement. Additionally, the heights of the trash bins do not conform to the standard height measurements specified in TS 12576 (1999) (Figure 9).

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Figure 9. Trash bins in Dokumapark

Fountains

The water drinking areas of fountains should be approximately 90 cm in height. The appropriate height for wheelchair users is 85 cm, while for other users, it's approximately 95 cm (UN, 2004) (Figure 10).

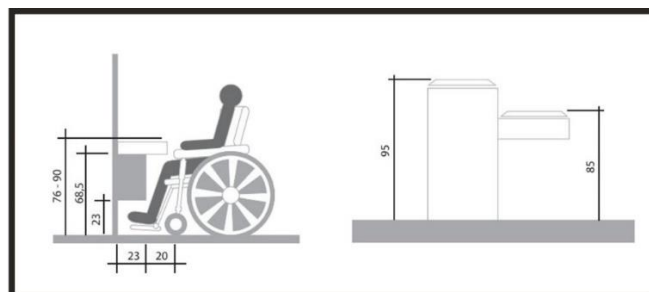


Figure 10. Standard measures of fountain (BM, 2004)

The measurements of the fountains within the study area are not suitable for the use of disadvantaged individuals. For visually impaired individuals, there are no guiding lines or elements indicating the location of the fountain (Figure 11).

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Figure 11. Fountains in Dokumapark

Lightnings

The height of lighting fixtures should be as follows: 3-4 meters for walking trials, 4.5-6 meters for streets, 7.5-9 meters for avenues, and 10-12 meters for main roads. In parks and gardens, low lighting fixtures should have a maximum height of 1 meter, and high lighting fixtures should have a maximum height of 2.4 meters (Kartay, 2009). According to TS 12576 (1999) criteria, the headroom clearance should be made at a height of 2.2 meters or higher (Figure 12).

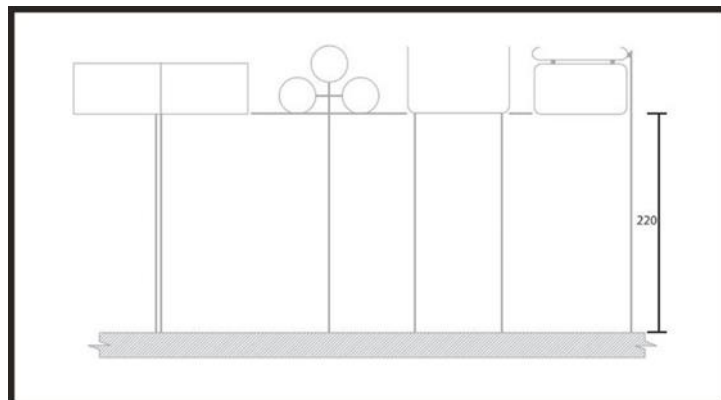


Figure 12. Mounting height in walking trial (TS 12576, 1999)

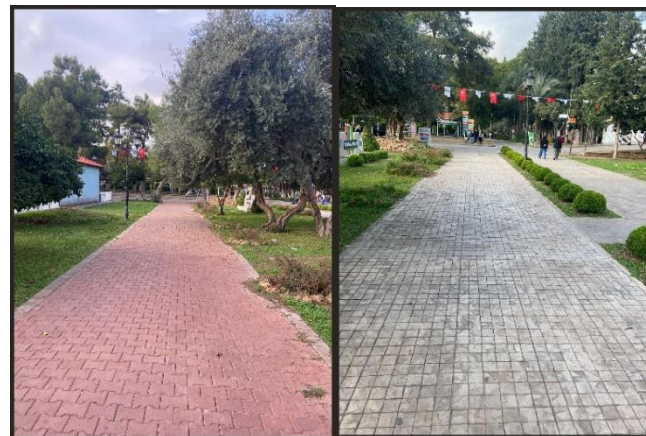
There are lighting fixtures with different heights within Dokumapark. All of the lighting fixtures have height measurements above the headroom clearance (Figure 13).



Figure 13. Lighting fixtures in Dokumapark

e. Plant materials

There are various plant species along the walking paths within the study area. The plants along the paths are adequately positioned at a distance from the path. However, some plants' branches extend to the walking paths. Additionally, there are no barriers or protective measures around the plant elements along the walking paths. Some sections have protective elements that visually impaired individuals can feel, separating the walking path from the green areas, while others do not have such elements (Figure 14).





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Figure 14. Plant materials in Dokumapark

f. Social furniture

Cemil Meriç Library

The library has stairs at the entrance but lacks a ramp for disabled individuals. However, there is an elevator designed for disabled individuals. The dimensions of the stairs (620 cm x 30 cm x 20 cm) do not conform to standards. Additionally, there are no detectable surface applications at the entrances, and there are no non-slip strips on the edges of the steps. Furthermore, the design is not suitable due to the empty space at the height of the steps (Figure 15).



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Figure 15. Entrance and disabled lift of Cemil Meriç library in Dokumapark

Open-air museum

The museum entrance is accessible through a 5 cm high step and a ramp. The entrance width (290 cm) is compliant with standards. However, there is no detectable surface application at the entrance (Figure 16).



Figure 16. Open-air museum in Dokumapark

Antalya science center

The Science Center has both stairs and a ramp arrangement at the main entrance. The dimensions of the stairs (500 cm x 30 cm x 20 cm) do not conform to standards. Additionally, there are no detectable surface applications at the entrances, no protective non-slip strips on the edges of the steps, and no protective curbs at the edges of the ramp (Figure 17).



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Figure 17. Entrance, ramp and stairs of Antalya Science Center in Dokumapark

Dokuma mosque

Dokuma Mosque only has a staircase arrangement at the main entrance. The dimensions of the stairs (210 cm x 30 cm x 20 cm) do not conform to standards (Figure 18).

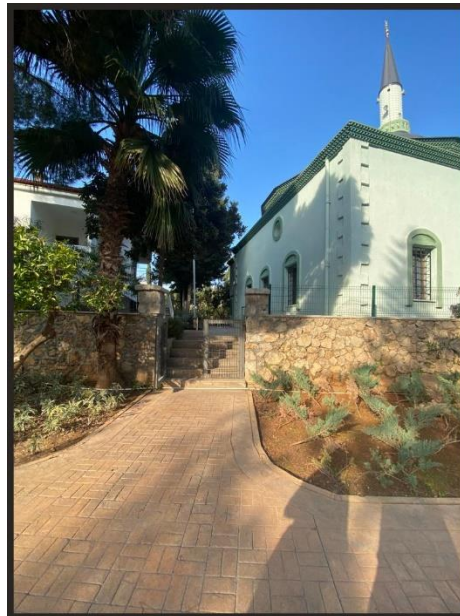


Figure 18. Entrance of Dokuma mosque in Dokumapark

Botanical garden

There are no ramp or staircase arrangements at the entrance of the Botanic Garden. In this sense, it is designed to be easily accessible to everyone. However, there is no detectable surface application for individuals with disabilities at the entrance (Figure 19).



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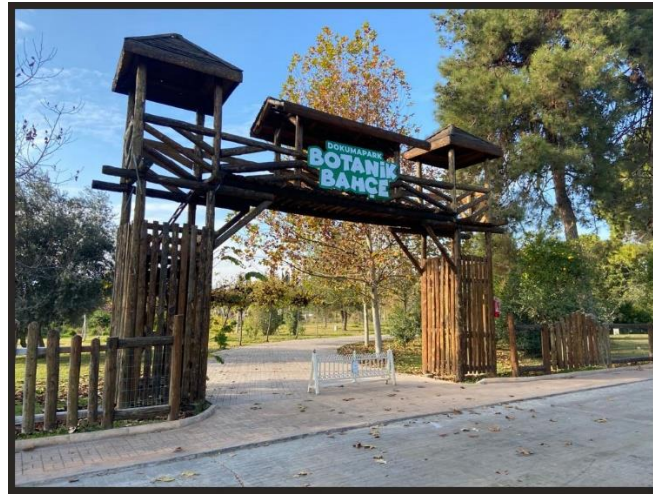


Figure 19. Entrance of botanical garden in Dokumapark

Antalya car museum

There are no ramp or staircase arrangements at the entrance of the Antalya Automobile Museum. In this sense, it is designed to be easily accessible to everyone. However, there is no detectable surface application for individuals with disabilities at the entrance (Figure 20).



Figure 20. Entrance of Antalya car museum in Dokumapark

Once Upon a Time Antalya Museum

There are both staircase and ramp arrangements at the entrance of the "Once Upon a Time Antalya Museum". The dimensions of the stairs (400 cm x 30 cm x 15 cm) are compliant with standards. There is a non-slip surface at the door entrance. However, there are no protective curbs at the edges of the ramp (Figure 21).



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Figure 21. Entrance of Once Upon a Time Antalya Museum in Dokumapark

Toys museum

The Toy Museum has a staircase arrangement at the main entrance, and on both sides, there are both staircase and ramp arrangements. The dimensions of the stairs (120 cm x 30 cm x 15 cm) comply with standards. Additionally, there are protective curbs at the edges of the ramp (Figure 22).

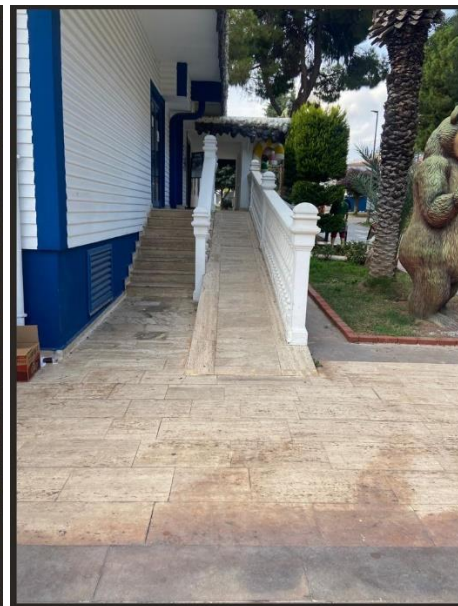
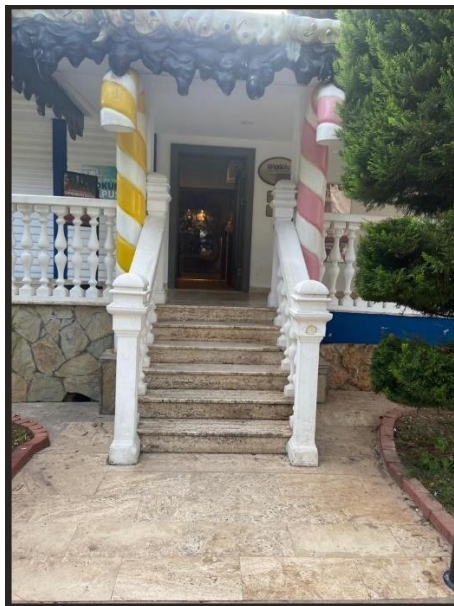


Figure 22. Entrance, ramp and stairs of Toys museum in Dokumapark

Second hand book market

Second hand book market does not have a defined entrance with boundaries. Cobblestone is used as the flooring material (Figure 23).



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Figure 23. Second hand book market in Dokumapark

Train library (Dr. Burhanettin Onat Children's Library)

The Train Library (Dr. Burhanettin Onat Children's Library) has both staircase and ramp arrangements at the entrance. The dimensions of the stairs (130 cm x 30 cm x 15 cm) comply with standards. At the beginning of the stairs, there is a landing with dimensions of 130 cm in length, 50 cm in width, and 15 cm in height. There are protective curbs at the edges of the ramp, and wood is used as the flooring material (Figure 24).

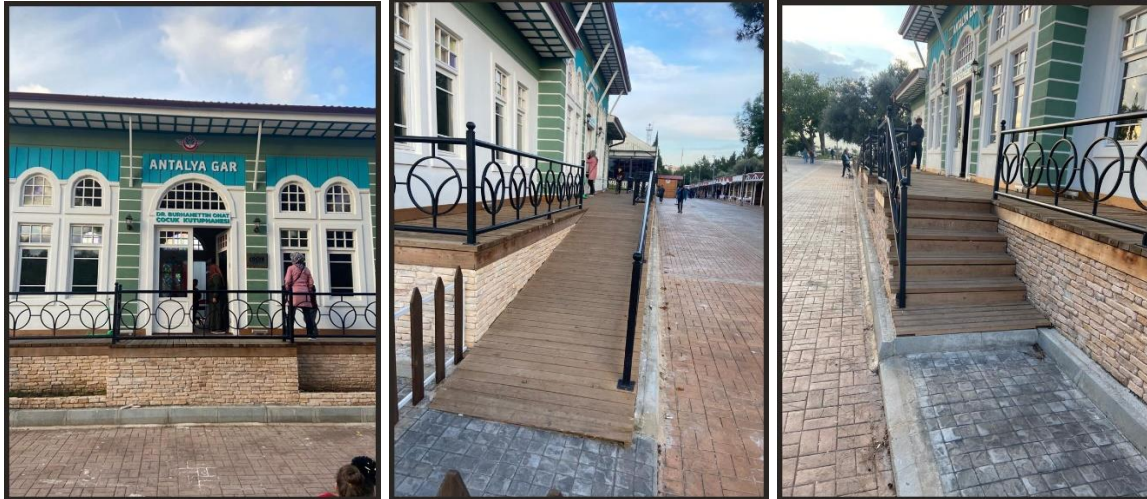


Figure 24. Entrance, ramp and stairs of train library in Dokumapark

Modern arts gallery

The Modern Arts Gallery has both staircase and ramp arrangements at the entrance. The dimensions of the stairs (610 cm x 30 cm x 15 cm) comply with standards. There are protective curbs at the edges of the ramp. However, there is no anti-slip strip application on the steps (Figure 25).



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Figure 25. Entrance, ramp and stairs of modern arts gallery in Dokumapark

Masjid and toilet

There are no staircase or ramp applications at the entrances of the masjid and Toilet-Washbasin (Figure 26).



Figure 26. Masjid and toilet in Dokumapark

4. CONCLUSIONS and SUGGESTIONS

In conclusion, urban open and green spaces are important places within the city where people can meet various needs such as relaxation and socialization. Parks, in particular, are significant public spaces within this classification. In this context, it is crucial that parks are accessible to everyone. Regardless of age or physical condition, all individuals should be able to access these spaces and fulfill their socialization needs.

As a result of this study, it has been determined that individuals' movements in Dokumapark, Antalya are restricted due to some errors and deficiencies in the implementation, and access to various facilities within the park is also limited. Here are the key conclusions and recommendations:



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- While the widths of the walking trials in Dokumapark are generally compliant with standards, the inappropriate paving materials restrict the movements of disadvantaged individuals. Moreover, there are no tactile-sensitive surfaces and walking lanes for visually impaired individuals on the park's trials. In areas with inappropriate materials, replacements should be made with suitable materials, and walking lanes that can be followed by visually impaired individuals should be created.
- The number of disabled parking spaces in Dokumapark does not comply with the parking regulation. Therefore, the number of designated parking spaces for disabled individuals should be increased.
- There is insufficient space for wheelchair users at the edges of the areas in Dokumapark. Therefore, areas should be created in seating areas where wheelchair users can also be comfortable.
- Trash cans in the study area are located along the walking paths and are fixed to the ground. This restricts the movement of users. The heights of the trash cans do not comply with the height dimensions specified in TS 12576 (1999). Urban equipment elements that do not comply with standards should be redesigned to make them suitable.
- Some of the plant elements along the walking trials extend their branches onto the trials. Especially in terms of posing a danger to visually impaired individuals, pruning and maintenance should be carried out regularly.
- There is an adequate number of directional signs in the study area.
- Non-compliant points in stairs and ramps at building entrances should be reorganized according to the standards, and protective curbs should be added to the ramps.
- To facilitate easy access for disabled individuals, the toilet, sink, and masjid in the study area should be arranged accordingly.
- There are no texture or color difference applications to indicate the locations of equipment for visually impaired individuals. In order to ensure easy access and recognition of urban and social furniture in Dokumapark, ground coverings should be designed with different textures and colors.

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INVESTIGATION OF WOODY PLANT MATERIAL IN SQUARES: CASE OF ANTALYA, TÜRKİYE

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ABSTRACT

Cities are complex structures that include areas such as residential, open and green, public, commercial, etc., where people meet their social, cultural and economic needs. Squares are one of the most important public open spaces in the cities, as they are known as a focal point of urban identity. In many cities, however, squares are far from being an attractive focal point. The aim of this study is to examine the woody plants used in the three main squares of Döşemealtı, Kepez and Muratpaşa counties in the central districts of Antalya, and also to evaluate the furniture in the square in terms of competence, functionality and aesthetics. As a result of the study, the highest number of woody plant species were detected in Kepez urban square while the highest number of woody plants was found in the Döşemealtı urban square. The woody species used in the squares are mostly exotic species, angiosperms and tree-formed plants. In addition, the rates of deciduous or evergreen woody species used in the squares are virtually 50%. Chamaecyparis lawsoniana, Pinus brutia and Araucaria heterophylla species were determined in two of the three squares, while the other detected species were in only one square. Moreover, according to the scoring results on the basis of the determined criteria, the most suitable square was Cumhuriyet Square in the Muratpaşa county. All of the examined squares are in good condition in terms of both accessibility and socialization of people. In conclusion, in addition to the design criteria, the functional and aesthetic elements of the plants should be considered together in the plant design of the squares.

Keywords: Square, Plant Material, Landscape Design.

1. INTRODUCTION

Cities are complex structures that fulfill the social, cultural, and economic needs of individuals, encompassing various elements such as housing, open green spaces, public areas, and commercial zones. Among these elements, urban open spaces, particularly parks, play a vital role in defining a city's identity. In this regard, the concept of squares or public plazas is significant.



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Squares are open spaces typically located in city centers where individuals gather and engage in various activities such as meeting and socializing (Oktay, 2017). Usually surrounded by streets and buildings, squares serve as the focal point of a city and evoke a sense of pause in people. Squares are open spaces accessible to the entire community (Ender Altay et al., 2022). The relationship between the city and the square should be evaluated and regulated with a comprehensive perspective (Turgut, 2020). Squares are symbolic spaces for the city. In this respect, their designs being unique and providing clues about the history and culture of their location make squares more attractive.

The concept of squares, as one of the most important public spaces in urban open space classification, has been present from ancient times to the present day. Throughout history, squares have served as meeting places for city dwellers or visitors, places where they can take a break from the hustle and bustle of the city, relax and rest, come together, and share the events happening in the city. In short, squares have been multi-purpose spaces (Akman, 2020; Bayrakdar et al., 2022). The only constant feature of squares throughout history is their central location in the city as urban open spaces and their importance in shaping the city. On the other hand, 20th-century squares have undergone changes due to urban developments (Önder & Aklanoglu, 2002) and are generally open spaces with hard surfaces where activities such as resting, strolling, and gathering take place (Yıldızhan, 2018; Tezer et al., 2023).

The location of squares is closely related to the structural order of the city when viewed as a whole (Özdoğan, 2019). City squares are located in areas at the intersections of busy streets, surrounded by roads, and carry traces of the city's past (Demirel, 2008). When squares are considered as the courtyard of the city, they have the quality to meet some of individuals' daily needs, contribute to the cultural aspect, and fulfill the needs for relaxation and entertainment (Özdoğan, 2019). When looking at developed cities in many countries, it can be seen that squares have significant effects on urban identity. Indeed, prominent cities in developed countries are known and symbolized by their squares. Many of these squares also serve as urban open spaces that meet the recreational needs of city dwellers.

Plants play an important role in the landscape design of squares. The qualities that plants bring to the space support the perception of the square. In square design, plants should be selected considering the climate, sunlight, and rainfall of the location (Başaran et al., 2020; Özer et al., 2020). The use of single trees, rows of trees, tree clusters, combinations of several trees coming together, and various other combinations of plant materials in squares create attractive spaces in terms of form and function (Erduran Nemutlu et al., 2021).

It is noteworthy that most of the studies conducted on squares have focused on urban furniture. Recently, there have been some studies on the plant elements of squares in different regions (Şenel, 2013; Erduran Nemutlu, 2014; Torlak Güneri & Yerli, 2019; Başaran et al., 2020; Erduran Nemutlu et al., 2021; Pashaei Kamali, 2021). In this study, the main squares of Döşemealtı, Kepez, and Muratpaşa districts in Antalya province were examined and compared in terms of the plant materials used.

2. MATERIAL and METHOD

This study was conducted in the main squares of Kepez, Muratpaşa, and Döşemealtı districts in Antalya, Turkey (Figure 1). The sizes of the studied squares and the plant materials used in them were identified. The research employed on-site observation and assessment methods.

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Within the scope of the study, woody plant species, including the number, variety, location of use, and manner of use of trees and shrubs used in the squares, were evaluated. Additionally, the squares were assessed based on criteria determined for general use, using a scoring method.

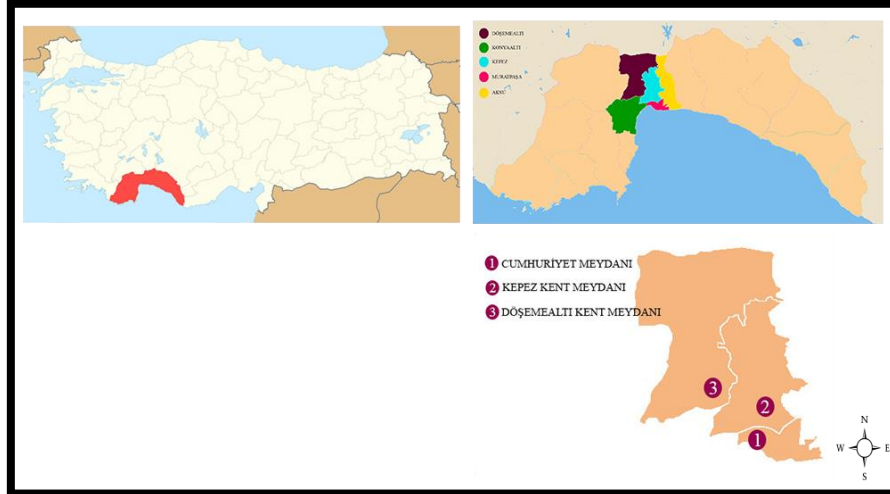


Figure 1. Location of study areas

Cumhuriyet Square is located on Cumhuriyet Avenue in Muratpaşa District of Antalya Province. To the north, it is bordered by Şehit Binbaşı Cengiz Toytunç Avenue and the Antalya Governorship, to the south by the Kaleiçi District, and to the west and east by various shops and businesses. Cumhuriyet Square underwent a significant transformation in 2008, resulting in a total area of 11,500 square meters. Kepez Kent Square, on the other hand, is situated on Seyhan Avenue next to the Turgut Özal Sports Hall and covers a sprawling area of 42,000 square meters. It holds the distinction of being the largest square in Antalya, completed in 2017. Döşemealtı Kent Square, completed in 2017, is the first square of Döşemealtı. It spans an area of 16,500 square meters. (Figure 2).



Figure 2. Locations of plant materials in Cumhuriyet (upper left side), Döşemealtı (upper right side) and Kepez (bottom side) squares



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3. RESULTS and DISCUSSION

Plants, which are vital sources of oxygen for our planet and cities, offer numerous ecosystem services. Their characteristics such as form, texture, seasonal colors, and leaf shedding, along with temporal changes, contribute to the attractiveness of spaces and create more dynamic environments from a functional perspective (Sarı & Karaşah, 2018). The presence of plant materials not only enhances the aesthetic appeal of a design but also provides functional contributions. It prevents spaces from appearing monotonous and adds value to the environment.

a. Döşemealtı urban square

A total of 766 woody plant specimens belonging to 8 species were identified in Döşemealtı Urban Square (Table 1; Figure 3). The most frequently used woody plant species in Döşemealtı Urban square was *Euonymus japonicus* Thunb., commonly known as "Taflan." It is observed that deciduous woody plants are not extensively used in the square. However, since squares are large open spaces, it is important to incorporate shade-providing tree species in appropriate locations.

Table 1. Plant materials in Döşemealtı urban square

Latin Name	Number
<i>Araucaria heterophylla</i> (Salisb.) Franco	8
<i>Ceiba speciosa</i> (A.St.-Hil.) Ravenna	18
<i>Chamaecyparis lawsoniana</i> (A.Murray bis) Parl	134
<i>Euonymus japonicus</i> Thunb.	565
<i>Hibiscus syriacus</i> L.	24
<i>Olea europaea</i> L.	3
<i>Pinus brutia</i> Ten.	4
<i>Washingtonia robusta</i> H. Wendl.	10

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Figure 3. Woody plants in Döşemealtı urban square

b. Cumhuriyet square

A total of 129 woody plant specimens belonging to 7 species were identified in Cumhuriyet Square (Table 2; Figure 4). The most frequently used woody plant species in Cumhuriyet Square was *Trachycarpus fortunei* (hook.) H.Wendl., commonly known as "Telli palmiye." The abundance of shade-providing and evergreen trees in the square indicates the consideration of both aesthetic and functional criteria in the design. While woody plants used in the square are generally arranged in rows, the *T. fortunei* species is clustered in groups. *Cupressus sempervirens* L. and *Celtis australis* L. woody plant species are used for surrounding the square.

Table 2. Plant materials in Cumhuriyet square

Latin Name	Number
<i>Celtis australis</i> L.	12
<i>Cupressus sempervirens</i> L.	15
<i>Cycas revoluta</i> Thunb.	16
<i>Ficus microcarpa</i> Vahl	5
<i>Ficus microcarpa</i> cv. "Bonsai"	27
<i>Pinus brutia</i> Ten.	10
<i>Pittosporum tobira</i> "Nana"	5
<i>Trachycarpus fortunei</i> (Hook.) H.Wendl.	44

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Figure 4. Woody plants in Cumhuriyet square

c. Kepez urban square

A total of 397 plants belonging to 19 species were identified in Kepez Urban Square (Table 3; Figure 5). The most frequently used woody plant species in this square was *Buxus sempervirens* L., commonly known as "şimşir." The dense use of this evergreen species suggests attention to aesthetics. Other frequently used species in the square were *Rosmarinus officinalis* L., *Chamaecyparis lawsoniana* (A. Murray bis) Parl and *Forsythia x intermedia* Zabel. It is worth noting that some of the plants in the square are arranged in rows, some provide shade to seating elements, while others are randomly placed and appear to be poorly maintained.

Table 3. Plant material in Kepez urban square

Latin Name	Number
<i>Aesculus hippocastanum</i> L.	3
<i>Araucaria heterophylla</i> (Salisb.) Franco	1
<i>Buxus sempervirens</i> L.	65
<i>Cercis siliquastrum</i> L.	5
<i>Chamaecyparis lawsoniana</i> (A.Murray bis) Parl	44
<i>Cinnamomum camphora</i> (L.) J. Presl	8
<i>Elaeagnus angustifolia</i> L.	1
<i>Eugenia uniflora</i> L.	24
<i>Ficus microcarpa</i> Vahl	15
<i>Forsythia x intermedia</i> Zabel	40
<i>Fraxinus angustifolia</i> Vahl	19
<i>Liquidambar styraciflua</i> L.	4
<i>Liriodendron tulipifera</i> L.	14
<i>Morus alba</i> L.	1
<i>Olea europaea</i> L.	3
<i>Populus tremula</i> L.	24
<i>Prunus cerasifera</i> Ehrh.	35
<i>Rhamnus alaternus</i> L.	31
<i>Rosmarinus officinalis</i> L.	60

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Figure 5. Woody plants in Kepez urban square

d. Furniture in squares

Furnishing elements used in open spaces are essential components that enhance both the aesthetics and functionality of spaces, making life easier for individuals (Özgeriş, 2018). Since squares are one of the most heavily used public spaces, well-designed and properly placed furnishing elements contribute to enhancing the attractiveness of the square. Elements like pergolas, gazebos, benches, trash bins, and others play a significant role in creating different effects in square designs. To consider a square successfully designed, it needs to meet certain criteria, with image and identity being one of the primary factors. A square should incorporate clues specific to the city it belongs to, include elements that reflect the city, and create an atmosphere that represents the unique character of the city.

When evaluating the squares in this study based on the established criteria, Cumhuriyet Square received the highest score. Cumhuriyet Square includes all water features, while Döşemealtı and Kepez squares only have fountains or ornamental pools. All three squares provide suitable conditions for people to socialize. Flexibility in design is also important for squares to adapt to changing weather conditions and events. This can be achieved through features like mobile stages, portable tables and chairs, umbrellas, and having storage on-site for these materials.

However, none of the squares examined in this study had a storage area with this function. Regarding accessibility, squares should be easily reachable on foot, have narrow streets surrounding them, well-placed pedestrian crossings, synchronized traffic lights near them, and slow-moving traffic. In this context, all three squares studied were found to be accessible (Table 4; Figure 6).



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Table 4. Scoring of the studied squares based on criteria

Criteria	Characteristics	Scoring (1-2-3)		
		Cumhuriyet	Döşemealtı	Kepez
Transportation	Connected to multiple boulevards or streets (within 0-100 meters)	3	2	3
	Public transportation passing by within 0-15 minutes frequency	3	3	3
	Density of private vehicle parking areas in the vicinity (200 meters and beyond)	3	1	2
	Size and Density 500 square meters or larger in size	3	3	3
Büyüklik ve Yoğunluk	Capacity for 250 people or more	3	3	3
	If the number of architectural elements in the vicinity is 2 or less (within 0-100 meters)	3	2	1
	If there are trees and shrubs	3	3	3
Plant Element	If there are shrub groups and clusters	2	3	3
	Y If there are ground cover and grass areas	2	3	2
	If there is a sea or river	2	0	0
Water Element	If there is a pool or ornamental fountain	3	3	3
	If there is a fountain or any other water element	2	0	0
	If there is an amphitheater or sculpture	3	1	0
Urban furniture	If there are pergolas, gazebos, benches, trash bins, etc.	2	2	3
	If there are lighting elements	3	3	3
Connection with Green Areas	If it is within a green belt	1	1	1
	If it is within a greenway	1	1	1
	If it is within urban parks	2	2	2
Land Uses	In proximity to public and cultural areas (within 0-500 meters)	3	2	3
	In proximity to commercial areas (within 0-500 meters)	3	3	3
	In proximity to residential and agricultural areas (within 0-500 meters)	1	2	3
Total		51	43	45

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Figure 6. Cafe, pergola, seating and lighting elements in Kepez urban square (a-e), Cafe, trash bin, seating elements in Döşemealtı urban square (f-i) and seating and lighting elements, statue and pool in Cumhuriyet square (i-k)

4. CONCLUSIONS and SUGGESTIONS

The main squares in the districts of Döşemealtı, Kepez, and Cumhuriyet in Antalya province exhibit a diversity of plant materials. The presence of a variety of plant species and the use of many different types of plants together make the squares richer and more perceptible. Furthermore, the combination of shade-providing tree species with pergolas in seating areas is beneficial both aesthetically and functionally.

Permeability in flooring materials is an essential criterion in terms of climate sensitivity. Therefore, the flooring materials used in squares should be designed with this consideration in mind, aiming to create green paths connected to the squares. The existence of green paths is crucial for pedestrian safety and climate sensitivity.

The presence of surrounding trees in the squares acts as a limiting factor in creating a sense of space while also providing shade. Cafes and cafeterias in the squares are considered as spaces for socializing and add meaning to the square. Additionally, the presence of a water element in the squares creates a refreshing effect required by the regional climate. In Kepez and Döşemealtı squares, addressing the absence of these elements will enhance their desired characteristics.



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In the planning and design of squares falling under the category of urban open spaces, planning and design criteria should be considered. In this context, the most crucial point to bear in mind is that squares are public spaces and should respond to public activities. They need to be functionally adequate while being designed with aesthetic considerations in mind.

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**EVALUATION OF KIZILDAĞ NATIONAL PARK IN TERMS OF DAILY
ACTIVITIES AND SPATIAL ADEQUACY**

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ABSTRACT

Even though Türkiye has more protected areas than ever, one of the ongoing issues with national parks is still the absence of inventory. It is challenging for national parks to make effective management and planning decisions as a result of this flaw. National parks, however, are among the most popular and successful spaces in Türkiye for addressing people's demands for recreation. In this study, Kızıldağ National Park located in Şarkıkaraağaç district of Isparta province was examined and evaluations were made in terms of daily activities and spatial competence. For this purpose, the spatial competencies of recreational activity areas, the existing furniture, infrastructure adequacy and the suitability of their recreational use were examined by using the observation and detection method. According to the data between 2018-2022, the average number of visitors to Kızıldağ National Park was 55539. It was found out in the national park that the area used for picnics was insufficient, there was no uniform distribution of playground, trash cans, toilets, or lighting furniture in the area, the furniture was made of materials unaesthetically and unsuitable, there was no parking area, and the accommodation units were large and occupied an excessive space. The picnic area should be removed from its current location and designed together with the parking lot in a different location. Both renewing the furniture with aesthetically pleasing and useful materials and ensuring their uniform distribution in the park are important. Re-planning the Kızıldağ National Park with a sustainable approach will ensure more effective use of the area by choosing an area suitable for recreational activities that will contribute to the needs of visitors and the protection of the area.

Keywords: National Park, Recreation, Furniture, Space.

1. INTRODUCTION

The unplanned growth initiated by the increasing world population, industrialization, urbanization, and the reckless use of natural and cultural resources have caused irreversible damage to the environment. Throughout history, humanity has endeavored to find solutions to these problems, leading to the emergence of the concept of nature conservation (Kılıç & Kervankıran, 2019). Nature conservation is defined as the protection of plant and animal species existing in nature, along with their natural habitats, under specific conditions, for the guarantee of human life (Yücel, 2005).



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Efforts to develop various conservation methods and tools for the preservation of natural and cultural resources are increasing worldwide. At the international level, one of the most advanced and widely accepted efforts is the establishment of protected areas (Kurdođlu, 2007). Many countries have designated natural, cultural, and historical sites as protected areas with the aim of preserving their existing characteristics for sustainable use (Yücel & Babuř, 2005). These protected areas play a vital role in national and international conservation efforts. Many areas rich in biological diversity and natural-cultural values are now designated as national parks, nature reserves, and other protected areas, serving the conservation of biological and cultural diversity (Gümüř et al., 2010).

Within areas of significant value, with the aim of preserving endangered species and natural-cultural values in the long term and passing them on to future generations, the concept of "National Parks" was introduced (Yücel & Babuř, 2005). National Parks are defined as natural areas with rare natural and cultural resource values, offering protection, relaxation, and tourism opportunities from both scientific and aesthetic perspectives (Anonim, 2023a).

In Turkey, the concept of national parks was first introduced through the Forest Law in 1956, prior to the enactment of the National Parks Law in 1983. National parks were designated under this law until 1983 (Koç & Soykan, 2020). However, it is noted that, compared to the United States and European countries, recent years have seen increased efforts in Turkey regarding national parks, and conservation activities are still carried out within the framework of traditional planning (Bayar & Göktuđ, 2021). Currently, there are 48 national parks in Turkey, covering a total area of 911,000 hectares (Anonim, 2023b).

National parks in Turkey have gained increasing importance and attract numerous visitors today (řahbaz & Altınay, 2015). These parks offer various recreational activities such as nature walks, camping, rock climbing, canyon crossings, water sports, cycling, bird watching, mountaineering, photography, picnicking, flora-fauna observation, and fishing (řahbaz & Altınay, 2015).

While several studies have been conducted on the recreational values and uses of national parks in Turkey, including examinations of the recreational values of Kastamonu-Bartın Küre Mountains National Park (Öztürk, 2005), the recreational use and conservation of Yozgat Çamlık National Park (Ergen, 2005), visitor-related issues in Antalya Olimpos-Beydađları Coastal National Park's day-use recreational areas (Uzun et al., 2014), determining the quality of recreational experiences in Ilgaz Mountains National Park (Göktuđ & Yenilmez Arpa, 2015), and factors affecting recreational satisfaction of users in Aksaray Altındere Valley National Park (Aksu et al., 2017), there has been no study to date that examines day-use activities and spatial adequacy in Kızıldađ National Park. This study aims to identify day-use activities conducted in designated outdoor recreation areas within Kızıldađ National Park, analyze the spatial adequacy of recreational areas, assess their deficiencies, and contribute to landscape projects in the national park based on the study results.

2. MATERIAL AND METHOD

The Kızıldađ National Park, located within the boundaries of Isparta province, was declared a National Park on May 9, 1969, with an initial area of 2,316 hectares, with the aim of preserving and passing on its biological (flora, fauna, ecological structure), geomorphological, geological, cultural, landscape, and recreational resource values to future generations. In 1993, the national



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park's area was increased to 59,400 hectares, and in 2018, it was further expanded to 80,200.42 hectares (Anonymous, 2023c).

Kızıldağ National Park is situated in the Western Mediterranean Region, within the administrative boundaries of Isparta province, including the districts of Şarkikaraağaç, Yenişarbademli, Aksu, Eğirdir, and Sütçüler (Figure 1). Located in the northern and western parts of Lake Beyşehir, Kızıldağ National Park lies between the north latitudes of $37^{\circ} 28' 30''$ - $38^{\circ} 31' 21''$ and the east longitudes of $31^{\circ} 31' 37''$ - $31^{\circ} 30' 12''$. To the north of the national park are the Şarkikaraağaç district center, Beyköy, Şarkikaraağaç-Beyşehir asphalt road, to the east is Lake Beyşehir, to the southeast are the northwestern parts of Gölyaka and Yenişarbademli districts, to the south are the villages of Aşağıkartoz, Aşağıyaylabel, and Yukarıyaylabel within the boundaries of Sütçüler district, to the southwest are Eldere Village, Aksu Yaka Canyon, Aksu district, Sarıdris, Bağacık Villages, and Anamas Plateau (Anonymous, 2023c).

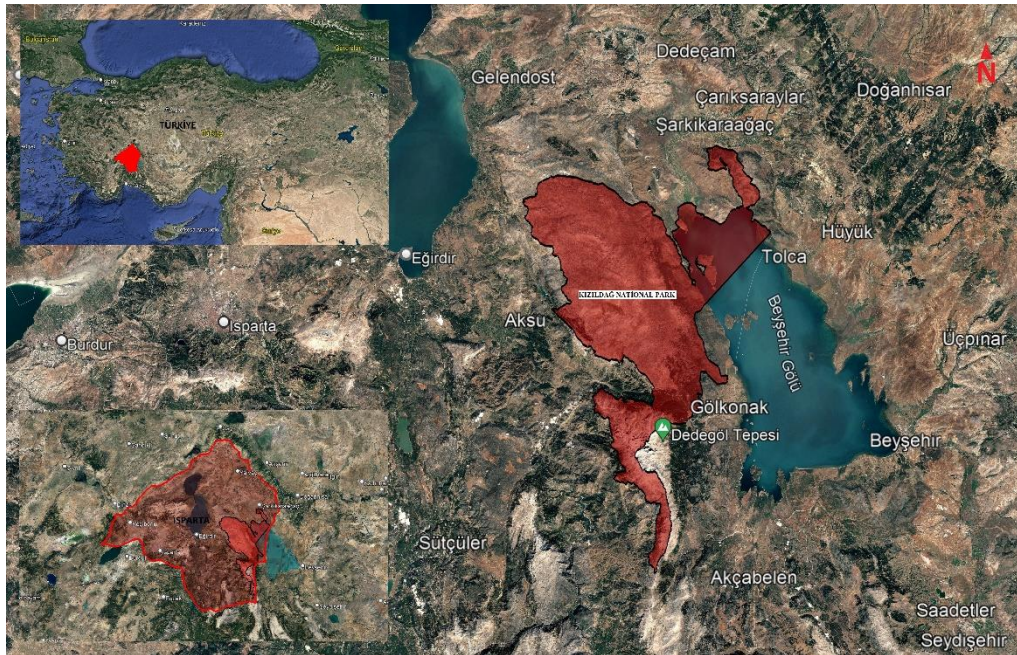


Figure 1. Location of Kızıldağ National Park

In Turkey, National Parks are managed by the Ministry of Agriculture and Forestry, Directorate General for Nature Conservation and National Parks, both at the central and provincial levels, with the principle of conservation-use balance, following the preparation of Long-Term Development Plans (UDGP) at a scale of 1/25,000. These plans determine the absolute protection, sensitive protection, sustainable use, and controlled use zones and activities, guided by an analytical study, synthesis, and planning approach.

Within the boundaries of the study area, the spatial adequacy of day-use recreational activity areas designated for open-air recreation activities has been determined using observation and assessment methods. This assessment includes the examination of existing infrastructure elements, spatial adequacy, and the suitability of day-use recreational activities for the area. The data obtained from these assessments have been supplemented with photographs taken in the field.



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3. RESULTS and DISCUSSION

The day-use area of Kızıldağ National Park, located within the boundaries of Şarkikaraağaç district in Isparta province, is approximately 7 km away from the town center. Within the day-use area, there are various facilities and amenities, including cottages (bungalows), tent camping areas, a countryside restaurant, a traditional Turkish tent restaurant, a children's playground, an oven, a buffet, sales units, a mosque, toilets, shower cabins, lighting elements, information, warning, and directional signs, walking paths, an entrance control unit, water fountains, trash bins, picnic units (picnic tables, barbecue grills), and shading elements (pergolas) (Table 1; Figure 2).

Table 1. Furniture in Kızıldağ National Park

Furniture	Number	Material
Entrance control unit	1	Wooden
Camp area with tent	1	
Portable sale stand	4	Wooden
Bungalow	5	Wood reinforced concrete
Casino	1	Wood reinforced concrete
Restaurant	1	Bristle tent
Playground	2	Plastic, metal, wooden
Cookstove	1	Concrete
Buffet	1	Wooden
Masjid	1	Wood reinforced concrete
Picnic units	150	Wooden
Pergola	5	Wooden
Toilet	6	Concrete, container, wood reinforced container
Shower bath	4	Concrete, wood reinforced container
Fountain	3	Concrete
Joint facility building	1	Concrete
Walking trails	-	Slate flooring
Trekking routes	3	stabilized soil road
Information, orientation and warning signs	15	Wooden, metal
Trash cans	25	Metal
Lighting elements	73	30 metal, 43 metal on access road and solar panel

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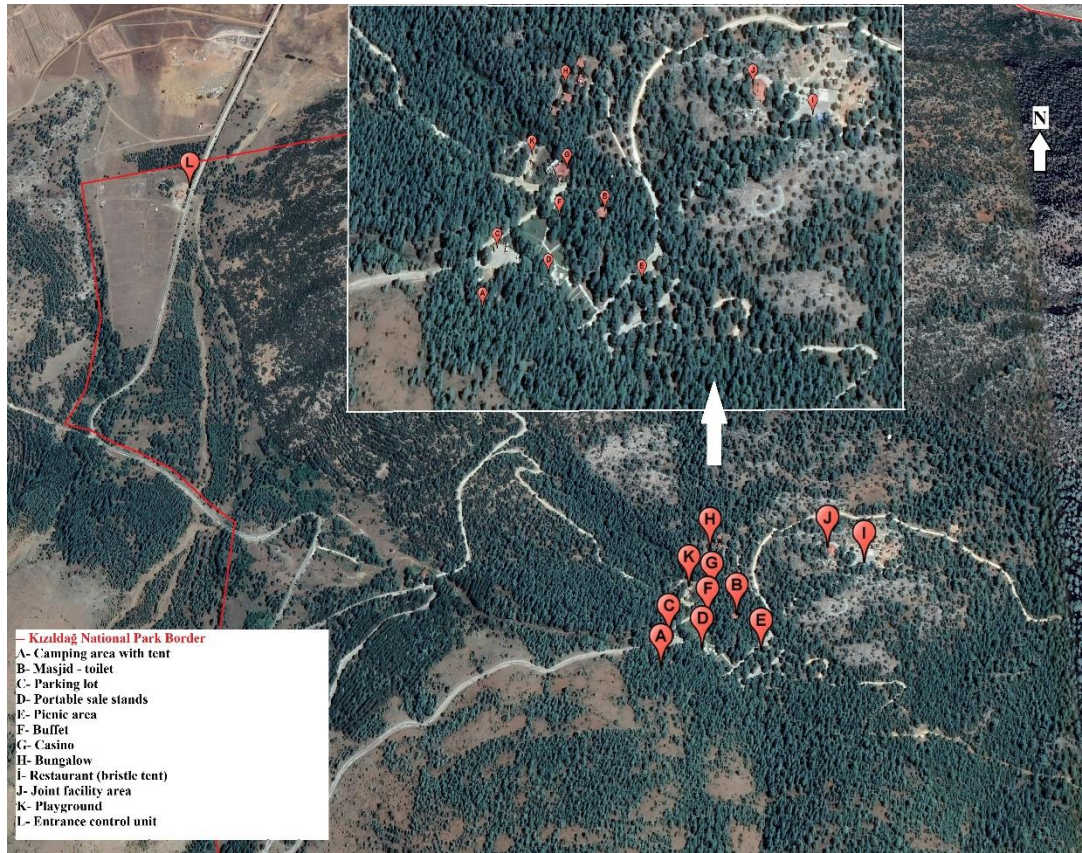


Figure 2. Daily use area in Kızıldağ National Park

Access to the National Park area from the town center of Şarkikaraağaç is provided via an asphalt road, and visitors are required to pay an entrance fee for admission. There is an entrance control unit with an area of 5 m² made of wood, and an entrance gate covering the road section (Figure 3).



Figure 3. Entrance control unit



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The day-use and camping area is accessible from the entrance control unit via an approximately 3.5 km asphalt road. On the left (south) side of the asphalt road, connected to the road circulation within the day-use area, there is an area of approximately 2000 m² that is used as a tent camping area. Due to the sloping topography of the tent camping area, 75 tent sites have been created using a terrace method. The tent camping area includes an electrical panel, and electrical outlets are provided on the wall surfaces of the established terraces for visitors' convenience. For visitors in the camping area, two wooden-clad container cabins have been placed, each consisting of a toilet and shower section, measuring 2.5 * 2.5 m. In the camping area where making fires for picnicking purposes is not allowed, picnic units (picnic tables) are available for visitors to use (Figure 4).



Figure 4. Camping area with tent

There is currently no designated parking area for day-use activities and accommodation purposes for visiting vehicles. As a result, vehicles are parked irregularly along the roadside, restricting the use of the area (Figure 5).



Figure 5. Irregular car parking



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Within the area, there are five duplex-style cottages (bungalows) located in the same vicinity as the countryside restaurant. Each bungalow, along with its terrace, covers an area of approximately 90 m² and is constructed with a wooden cladding on a reinforced concrete base. In a study conducted by Korkmaz (2001), it was mentioned that in 1987, five bungalows, common facilities, a restaurant-bakery, toilets, and other infrastructure facilities were completed in Kızıldağ National Park. The connection paths between the cottages are paved with slate and bordered by wooden railings (Figure 6).



Figure 6. Bungalows

Within the area, there are two countryside restaurants that cater to visitors' dining needs, including a countryside restaurant and a traditional Turkish tent (bristle tent) restaurant. The countryside restaurant, located adjacent to the cottages, has a closed area of 170 m², and its terrace, extended with wooden materials, covers an approximate area of 230 m², where meal and picnic tables are provided. The two-story building also includes a lower floor with an area of approximately 80 m², housing a stone oven and an annex section consisting of three rooms. The traditional Turkish tent restaurant is situated to the northeast of the countryside restaurant, approximately 20 meters higher in elevation and 250 meters further away. The bristle tent restaurant has a closed area of 65 m², including a kitchen section and seating groups. The open area, partially paved with cobblestones, covers 3,000 m² and features picnic tables, five wooden pergolas, and a panoramic photo shoot area with a scenic view. In the same open area, there is a combined 230 m² reinforced concrete facility (toilet, bathroom), and visitors park their vehicles in this open area (Figure 7).

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Figure 7. Bristle tent, restaurant and photo shooting area

There are two children's play areas within the vicinity, one located in the lower part of the countryside restaurant (40 m²) and the other at the entrance of the traditional Turkish tent restaurant area (25 m²). These play areas feature metal-plastic and wooden play equipment (Figure 8). Öztürk & Gül (2020) emphasized the use of natural play elements (wood) and materials that promote physical and mental development when planning children's play areas.

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Figure 8. Playgrounds

There is a snack bar with a total area of 30 m² (indoor) and 15 m² (outdoor) that offers products catering to visitors' needs. Additionally, there are four portable sales stands, each with a total area of 24 m² (indoor) and 26 m² (outdoor), made of wooden materials for selling souvenirs. The concrete mosque building within the area has been constructed with wooden cladding, covering an area of 60 m². It includes toilet and ablution facilities at the rear and a wooden minaret at the front (Figure 9).



Figure 9. Buffet, portable sale stands and masjid

There is one concrete restroom facility and six container restrooms within the area, covering a total area of 35 m². The concrete restroom and three of the container restrooms also include shower facilities (Figure 10). Restrooms with shower facilities are located within the tent camping area and in close proximity.

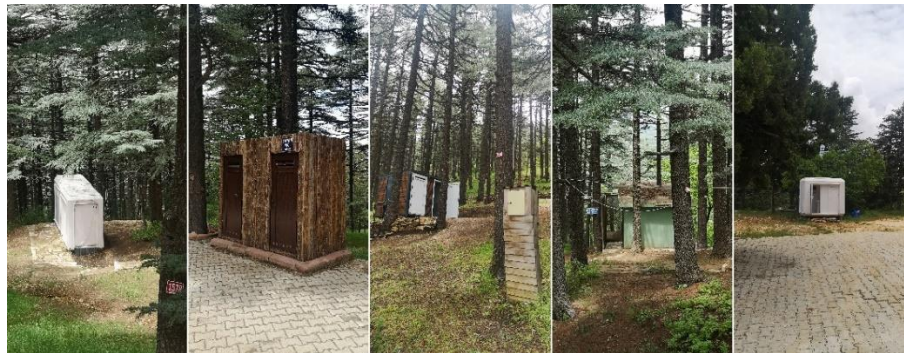


Figure 10. Toilet and shower units

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Within the area, there are fountains provided for visitors' drinking and utility water needs (Figure 11). When planning picnic areas in natural settings, Akten & Gül (2014) recommended an optimal range of 150-250 people per hectare (30-50 picnic units). However, it is anticipated that these picnic units should be positioned to serve an optimal range of 50-100 people per hectare (10-20 picnic units) while considering the balance between conservation and use. Additionally, the same authors suggested that for every 4 or 5 picnic units, there should be 1 fountain and 1 trash can.



Figure 11. Fountains

One of the primary reasons people prefer national parks is the availability of suitable picnic areas and the opportunity to connect with nature. Schroeder (1982) emphasized that natural green spaces and aesthetically appealing environments are particularly attractive to urban residents. For this reason, the national park includes a large picnic area covering 6,000 m² (0.6 hectares) where picnic units are located. There are 50 fire pits in the picnic area (Figure 12).



Figure 12. Picnic units

Throughout the area, there are various informational, warning, and directional signs with different designs, materials, and sizes (Figure 13). The diversity of signs in the area creates visual clutter and can be considered as visual pollution.

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Figure 13. Information, warning and orientation signs

One of the infrastructure elements, lighting fixtures, has been irregularly placed in various designs and sizes within the area. This irregular placement of lighting fixtures within the protected area creates an aesthetically negative appearance in the specially designated day-use and accommodation areas. Additionally, there is aerial cable clutter within the area (Figure 14).

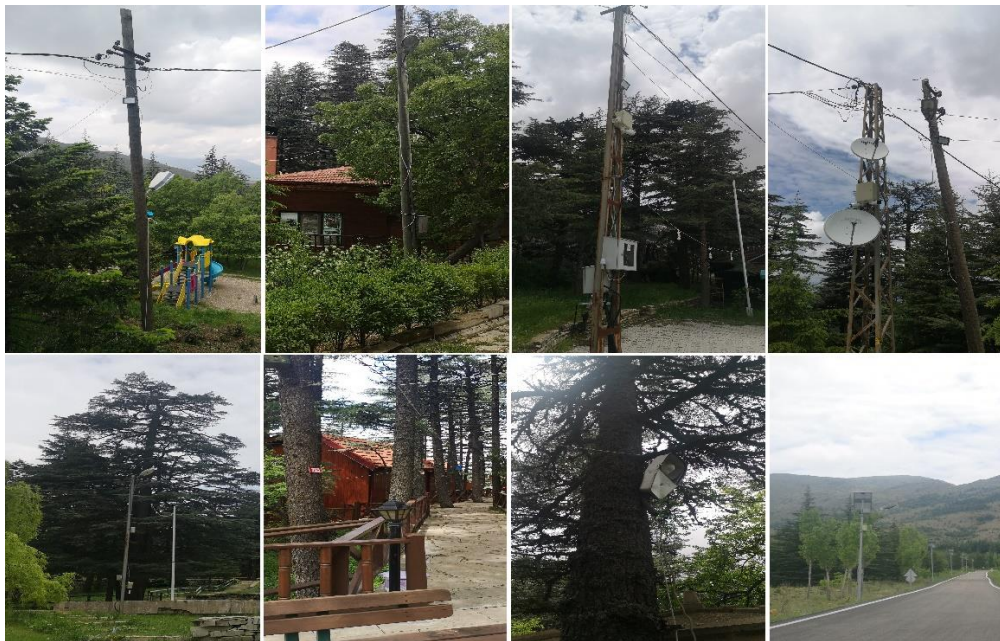


Figure 14. Lighting elements

At certain points within the area, there are metal trash bins (containers) in groups of various sizes and colors; however, they do not exhibit a homogeneous distribution within the area (Figure 15).



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Figure 15. Trash cans

The hiking trails within the day-use area provide access to the area's internal equipment (Figure 16). It is paved with slate stone as a building material and is bordered by wooden railings in some places. Stairs and steps are used in sloping areas. Due to the sloping topography of the area, the inclusion of steps in some hiking trails and the use of slate stone as the pavement material may not be suitable for disabled visitors.

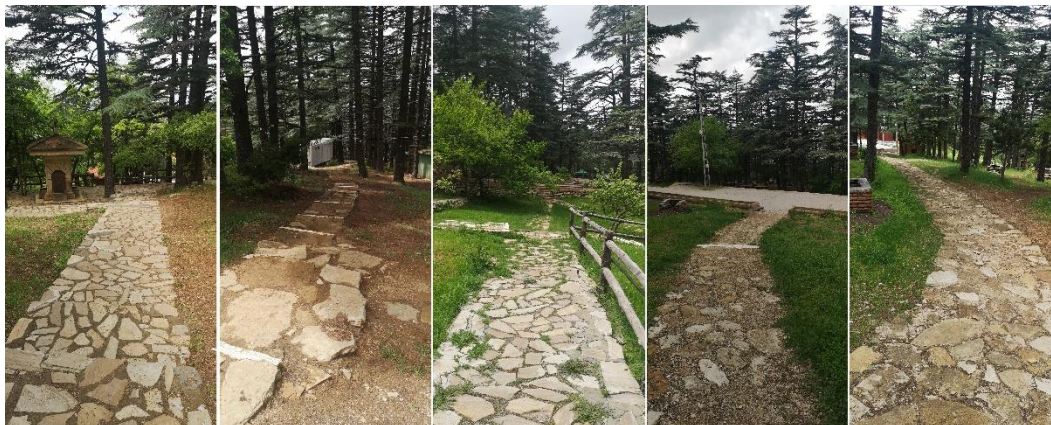


Figure 16. Walking trails

Existing forest roads within the area are used as nature hiking trails due to their high landscape value and panoramic views (Figure 17). The hiking trails, named Lake, Mountain, and Cedar routes, have lengths of 9.2 km, 6.5 km, and 3 km, respectively, and are heavily used by visitors. Direction and informational signs are located along the routes of the nature hiking trails.

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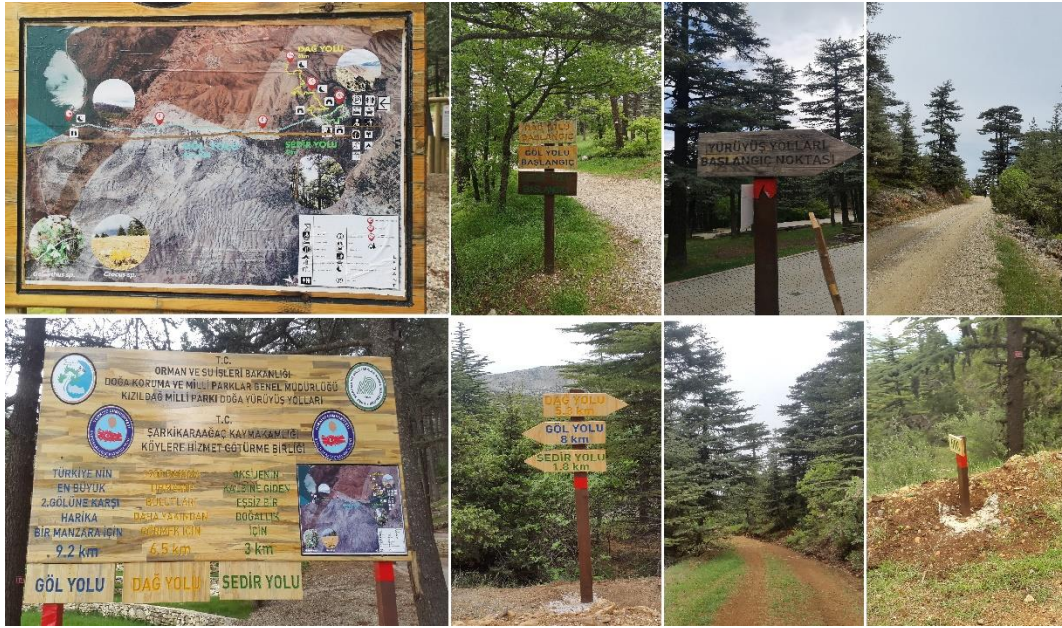


Figure 17. Trekking routes

According to the visitor data obtained from the Directorate of Nature Conservation and National Parks Isparta Branch for Kızıldağ National Park for the years 2018-2022, the annual average number of visitors was determined to be 55,539 people (Figure 18). On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic (Yücedağ & Çetin, 2020). To mitigate the impact of the pandemic and slow its spread, various measures such as curfews, quarantines, and isolation processes were implemented worldwide at different times (Bozkurt, 2020). Therefore, Kızıldağ National Park experienced a decrease in the number of visitors in 2021-2022 due to these measures.

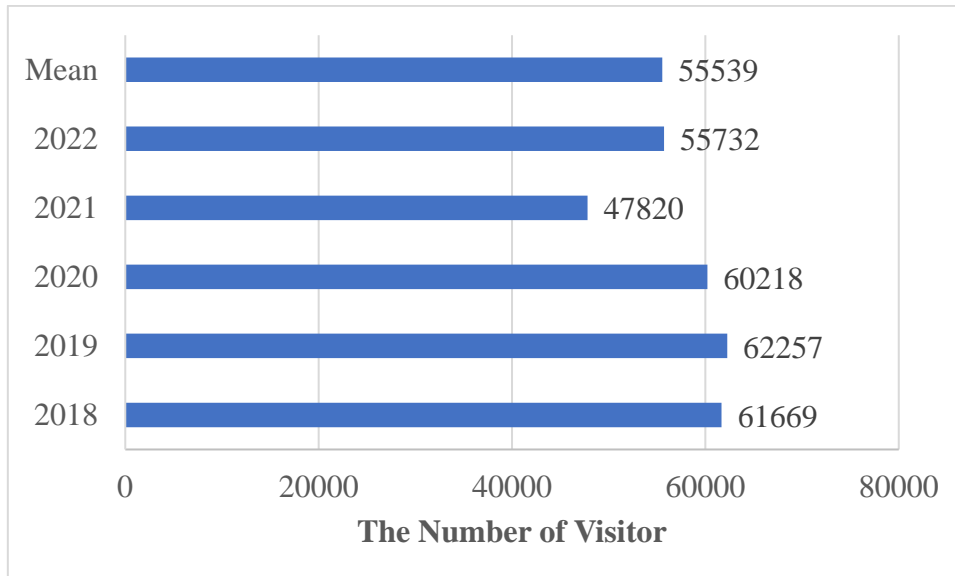


Figure 18. The numbers of visitor in Kızıldağ National Park between 2018 and 2022

4. CONCLUSION and SUGGESTIONS



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Kızıldağ National Park, one of the important national parks in Isparta province, Turkey, offers opportunities for outdoor recreational activities with its pristine forest areas and natural landscape beauty. Kızıldağ National Park is predominantly preferred by the local people for picnicking in the daytime. In addition to picnicking, activities such as hiking, enjoying the scenery, taking photographs, and camping tourism are carried out in the area. With various recreational activities available within the national park, the area has high visitor potential.

One of the key factors that affect the recreational potential and quality of a national park is the design of infrastructure elements, which should be in harmony with the natural characteristics of the area. These infrastructure elements should be well-maintained, clean, aesthetic, ergonomic, functional, accessible to people with disabilities, and compatible with other facilities within the park.

Based on the study conducted in Kızıldağ National Park, the following recommendations have been made:

- During the summer months when there is heavy usage by the public, the insufficient parking and picnic area lead to visual and noise pollution. Therefore, it is recommended to designate a suitable area near the entrance control unit for parking and picnic area expansion.
- It is suggested that the existing day-use area be used solely for accommodation and that internal shuttle services be provided for visitors.
- To ensure the conservation and sustainability of the existing natural resources, it is advised to use appropriate natural materials and aesthetic infrastructure elements in the park's design.
- The lighting elements within the park should have a consistent visual style and be uniformly distributed. Existing seating groups should undergo maintenance, replacement, or addition, and their numbers should be increased.
- Information, direction, and warning signs within the park should be designed in the right locations and with appropriate materials.
- Overhead power lines in the park, which disrupt the aesthetic and landscape integrity, should be buried underground.
- Trash bins within the park should be designed using suitable natural materials and should be evenly distributed in the area.
- Existing children's play areas, which are currently distant from the picnic area, should be reorganized to be closer to picnic units and have adequate space.
- Water fountains should be arranged within easy reach of visitors, and water sources should be increased.
- It is recommended to place single-story accommodation units with a smaller footprint, in compliance with legal regulations, instead of the existing duplex bungalows, which occupy excessive space.

In conclusion, national parks play a crucial role in meeting the recreational needs in Turkey. To make Kızıldağ National Park more suitable for recreational activities while preserving its



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natural resources, landscape design and implementation studies should be conducted, considering resource conservation, usage, functionality, and visitor expectations.

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**EVALUATION OF PROMENADES IN ISPARTA CITY CENTER IN TERMS OF
RECREATIONAL USE**

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ABSTRACT

Urbanization has dramatically increased both in Türkiye and around the world in recent years. This increase caused to serious health issues, particularly for urban areas. Spending time in open green spaces in or around the city is one method for overcoming these health issues. One of the city's open green spaces is promenade. Due to their natural resources, these spaces have a positive impact on the people. In this study, it was aimed to examine the Ayazmana, Gökçay and Milas Promenade areas located in the city of Isparta in terms of their recreational uses and to evaluate their shortcomings. For this purpose, the observation and detection method were used in the study areas. In order to reveal the current state of the study areas and to provide a basis for the evaluations, a SWOT analysis of the areas was performed. 16, 18 and 15 different furniture were identified in the promenades of Ayazmana, Gökçay and Milas, respectively. It was revealed that the Gökçay promenade had more furniture than other examined areas, and that they are more well-maintained and adequate. Periodic maintenance works should be carried out in terms of the functionality and sustainable use of the existing furniture in the promenades. Intensive use of furniture by the urban people causes their wearing and damaging, and various vandalism acts. In order to prevent such harm, the public should be informed. In addition, a total of 21 broad-leaved and 6 coniferous species were determined in the plant species inventory in the examined areas. Including plant species with high aesthetic value and plant diversity in future plant design projects for these promenades will contribute to their recreational values. In conclusion, a novel approach to the planning and management of these promenades needs to be put into practice.

Keywords: Promenade, Recreation, Isparta, Open-Green Area.

1. INTRODUCTION

Urbanization is the process that emerged as people abandoned a nomadic lifestyle and embraced settled living, leading to the growth of cities and the formation of today's urban areas. Urbanization is a population accumulation process that creates organization, occupations, and specialization, leading to changes in human behavior and relationships, largely driven by industrial and economic development (Keleş, 2002).

Urbanization offers some social and cultural benefits to individuals but also imposes the necessity of living in an artificial and unhealthy environment (Önder & Polat, 2012). The



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negative urban living conditions, such as intense work schedules, population density, noise, environmental pollution, artificial human relationships, etc., can lead to physical and emotional strain on people (Jitaru et al., 2012). Due to these challenges, urban residents often feel the need for nature. One of the spaces that fulfill this need in cities is open green spaces. Open green spaces not only satisfy the urban population's need for nature but also improve overall living conditions by addressing various challenges (Yücedağ et al., 2021).

Apart from architectural structures within urban areas, the spaces, green areas, and water elements that are found in cities are referred to as urban open green spaces. These spaces play roles in controlling urban development, creating unity and separation, providing aesthetics, ecology, economy, and recreational contributions to cities (Çelikyay, 2017). Urban open green spaces are used by many people daily regardless of their demographic characteristics and socio-economic status. They improve the quality of life both physically and psychologically (Abbasi et al., 2016), help balance the disrupted relationship between humans and nature, and enhance urban living conditions (Gül & Küçük, 2001). They also meet the recreation needs of urban residents for free and are managed by local authorities. Urban open green spaces can be categorized as active and passive. Active urban open green spaces include park areas, children's playgrounds, sports areas, Promenades, while passive urban open green spaces encompass medians, cemeteries, landscaped areas, and forested areas (Önen, 2015).

According to the Turkish Language Association (TDK, 2023), "mesire" refers to places suitable for walking, picnicking, and "mesirelik" refers to places suitable for leisure and picnicking. According to the Mesire Area Implementation Communiqué (Anonim, 2015), a mesire area is a forest-regime area designated for use with the necessary structures, facilities, and furniture to meet various relaxation, entertainment, and sports needs of society, contribute to the beauty of the country, and provide opportunities for tourism activities. The term "mesire" carries the same meaning as the word "recreation" and is used to describe areas where outdoor recreational activities take place (Kuş Şahin & Önder, 2021).

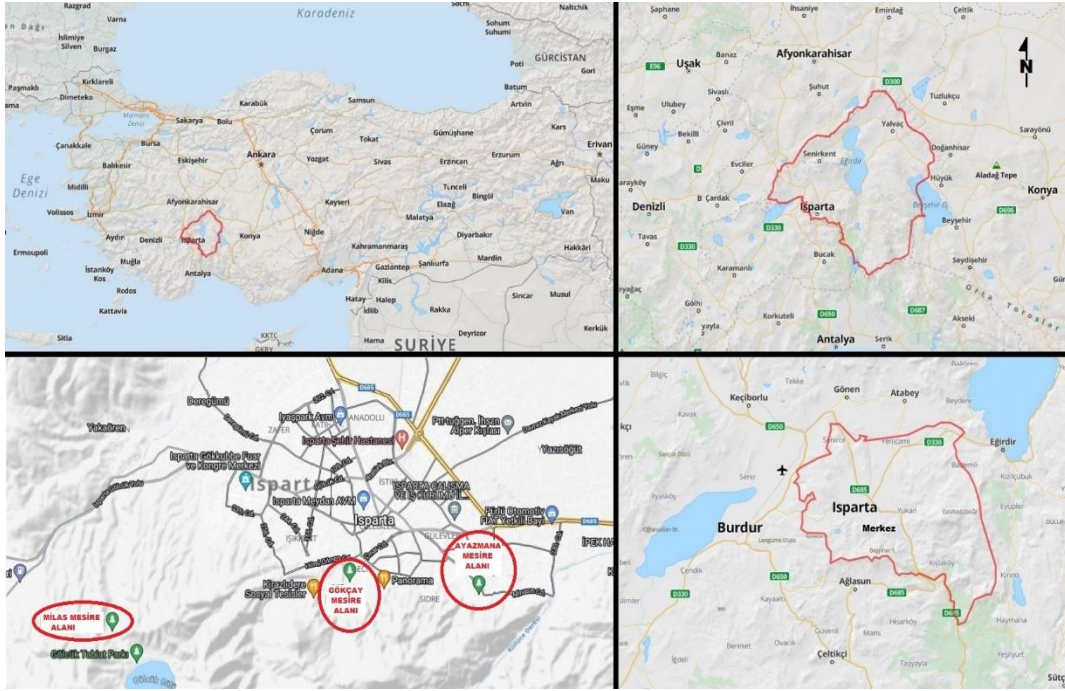
Recreational activities, which aim to enhance the quality of life and are voluntarily performed by individuals to refresh themselves physically and mentally, have become a necessity in human life (Köse & Kul, 2020). Outdoor recreation refers to activities carried out in natural or green areas where people can access nature beyond their working and essential needs (Türkmen et al., 2013). Urban open green spaces serve as venues for these recreational activities and help individuals balance their urban lifestyle with a connection to nature (Polat & Önder, 2004). Outdoor recreation activities can be both active and passive (Öztürk, 2018).

In Turkey, several studies have been conducted on visitors' recreational preferences and the recreational potential of mesire areas in various regions, including Beynam in Ankara-Bala district (Kaya & Yılmaz, 2013), Ekşisu in Erzincan-Merkez district (Yalçınayavuz & Yılmaz, 2016), Kepez Kent Ormanı in Antalya-Kepez district (Kuş Şahin & Önder, 2021), Harbiye (Daphne) Şelalesi in Hatay-Harbiye district (Yiğit, 2021), and Orduzu-Pınarbaşı in Malatya-Battalgazi district (Tapan, 2022). These studies aimed to determine visitors' recreational use patterns and preferences, as well as the recreational potential of these areas. However, no study has been conducted to evaluate the recreational use of Ayazmana, Gökçay, and Milas mesire areas in Isparta city center. Therefore, this study aims to examine these mesire areas in terms of recreational use, assess their deficiencies, and contribute to future landscape planning efforts in these areas.

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2. MATERIAL and METHOD

The study area includes the Ayazmana, Gökçay, and Milas Promenades located in the city center of Isparta, which is situated in the western Mediterranean region of Turkey. Isparta is bordered by Afyon to the north, Antalya to the south, Burdur, Denizli, and Uşak to the west, and Konya to the east (Figure 1).



Şekil 1. Location of study areas

The first of the study areas is the Ayazmana Promenade, established in 1996 (Serin, 2004). It is located between the Halikent and Vatan neighborhoods in the southeast part of the central district. The general area covers 18 hectares, with elevations ranging from 1030 to 1140 meters, and the dominant aspect is northward, with an average slope of 30%. A significant portion of the Promenade is covered by natural Anatolian chestnut (*Castanea sativa* Mill.) forest vegetation (Genç et al., 2001). Notably, on April 28, 2021, 17 Anatolian chestnut trees within the Ayazmana Promenade were registered as Monumental Trees (Amt Ağaç) (Anonymous 2022).

The second study area, Gökçay Promenade, is located in the southern part of the central district of Isparta, within the borders of Keçeci Neighborhood. The Promenade was established on an area of 60 hectares in 2003 (Serin, 2004).

Both Ayazmana and Gökçay Promenades, being close to the city center, are heavily used by the city's residents, especially during the spring and summer seasons and on weekends. Due to the high visitor potential, they fall under the category of Type B Promenades in the Promenade Implementation Regulation (Anonim, 2015). Both of these Promenades are owned by the Isparta Municipality.

The third study area, Milas Promenade, is located in the village of Yakaören, which is accessible from the city center of Isparta via a 10-kilometer asphalt road. It borders the Isparta Gölçük



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Nature Park and covers an area of approximately 5 hectares. In 2020, the name of the area was changed to "Milas Millet Bahçesi" (Milas People's Garden) as a result of renovation work carried out by the Isparta Governorate (Anonim, 2020). On September 30, 2009, the Antalya Cultural Heritage Preservation Board declared Milas Promenade as a 2nd-degree Natural Conservation Area (Doğal Sit) (Anonim, 2021) as part of the reevaluation of conservation statuses conducted by the Ministry of Environment, Urbanization, and Climate Change.

Milas Promenade, due to its distance from the city center, relatively small size, and proximity to the day-use area of the Isparta Gölcük Nature Park, has a moderate to low visitor potential. Therefore, it falls under the category of Type C Promenades in the Promenade Implementation Regulation (Anonymous, 2015). This area is owned by the Isparta Provincial Special Administration.

In the determination of recreational uses in the study areas, observation and recording methods were employed, and the data obtained were supported by photographs taken in the field. In this study, a SWOT analysis was conducted for the study areas to reveal their current status and provide a basis for evaluations. The analysis covered the presence of active green areas, the existing plant species used in green areas, furniture elements (seating units, lighting elements, warning and directional signs, decorative fountains, fountains, art objects, shading elements, pergolas, boundary markers, sales units, children's play and sports area elements, surface coatings, etc.), recreational uses (picnicking, sports, walking, dining, entertainment, cultural activities), and accessibility to the areas. For the identification of plant species in the study areas, Yaltrık & Efe (2000) and BITKIVT (2023) sources were utilized.

3. RESULTS and DISCUSSION

a. SWOT analysis

The SWOT analysis conducted for the Promenades is presented in Table 1. According to the analysis, the strengths of the Ayazmana, Gökçay, and Milas Promenades include their proximity to the city center, the richness of the existing flora, and the high landscape values. On the other hand, their weaknesses include inadequate cleanliness and maintenance of the areas, as well as the rugged and sloping terrain of the sites. The greatest opportunity for each area lies in their proximity to the city center and the potential for increased infrastructure development.

Table 1. SWOT analysis for three promenades in Isparta city center

Strengths	<ul style="list-style-type: none">➤ Easy accessibility from the city center.➤ Historical establishment dates of Promenades.➤ City park-like qualities of Ayazmana and Gökçay Promenades.➤ Rich existing flora.➤ Ownership by local authorities.➤ No infrastructure deficiencies.➤ Proximity of Ayazmana and Gökçay Promenades to the city center.➤ Presence of artificial and natural water sources.➤ High landscape (scenic) values of Promenades.➤ High demand from the city's population for green spaces and nature.
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Weaknesses	<ul style="list-style-type: none"> ➤ Promenades being dirty and poorly maintained. ➤ Incidents of vandalism in the areas. ➤ The steep and uneven terrain of Gökçay and Ayazmana Promenades. ➤ Limited accessibility to water in all areas.
Opportunities	<ul style="list-style-type: none"> ➤ The potential to serve as a green space within the city. ➤ The potential to become a significant focal point within the city. ➤ Abundance of recreational opportunities in the areas. ➤ High potential for infrastructure improvement. ➤ Increasing demand among the city's population for open green spaces and recreational activities. ➤ Proximity of Promenades to forest ecosystems.
Threats	<ul style="list-style-type: none"> ➤ Lack of regular maintenance and cleanliness of the areas, ➤ Increasing environmental, air, and noise pollution, ➤ Insufficiency of amenities (lighting, directional signs, and picnic units), ➤ Vulnerability to earthquakes.

b. Furniture analysis in the studied promenades

Urban furniture elements are crucial components that define the areas they are located in and facilitate both individual and societal life within a city. They contribute significantly to the formation of a city's identity by providing functional and aesthetic features to the area (Kuter & Kaya, 2019). It is well-known that these elements should be in harmony with open green spaces, ensuring the necessary safety and ergonomic conditions, and featuring designs that enhance the quality of life for users (Akten & Yücedağ, 2022).

i. Ayazmana promenade

Ayazmana promenade a total of 16 furniture elements, which include lighting fixtures, seating groups, parking lots, trash cans, warning and directional signs, bicycle parking, sales units, a restaurant, a cafeteria, decorative fountains, sculptures, a theater area, toilets, fountains, children's playgrounds, and sports facilities. Among these, 8 are well-maintained, and 6 are considered sufficient (Table 2; Figure 2).

Table 2. Furniture analysis for Ayazmana promenade

	Existence	Maintenance	Adequacy
Playground	Yes	Well-kept	Adequate
Sales unit, buffet	Yes	Well-kept	Adequate
Cafe, restaurant	Yes	Well-kept	Adequate
Walking trail	Yes	Neglected	Inadequate
Parking lot	Yes	Well-kept	Inadequate
Ornamental pool	Yes	Well-kept	Adequate
Lighting elements	Yes	Neglected	Inadequate
Fountain	Yes	Neglected	Inadequate



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Entertainment center (Wedding salon etc.)	No	-	-
Statues	No	-	-
Trash cans	Yes	Neglected	Inadequate
Sport facilities	Yes	Well-kept	Inadequate
Seating elements	Yes	Neglected	Inadequate
Picnic tables	Yes	Neglected	Inadequate
Gazebo etc.	Yes	Neglected	Inadequate
Theatre	Yes	Well-kept	Adequate
Warning and orientation signs	Yes	Neglected	Inadequate
Toilet	Yes	Well-kept	Adequate



Figure 2. Views from parking lot and spring water in Ayazmana promenade

Due to the topographical structure of the Ayazmana promenade, which is hilly and rugged, there is a large children's playground, sports facilities, and a walking path at a distance from the picnic units (Figure 3).



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Figure 3. Playground and sport facilities in Ayazmana promenade

Picnic units in the picnic area are located using a terrace system. Within the area, there is an amphitheater, sales units, and a cafeteria. Trash bins, lighting units, and directional signs are positioned differently in the area (Figure 4).



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Figure 4. Lighting units, amphitheater, trash bins, and sale units in Ayazmana promenade

In the case of the lack of recreational use in the Ayazmana promenade, the most fundamental issues are pollution and inadequate facilities. Similarly, Gülez (1990) stated that recreational facilities enhance the potential of the area. There are no pathways for disabled citizens in the



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Ayazmana Picnic Area. The amphitheater, trees or shrubs, children's play areas, and many seating groups in the area are at serious risk of vandalism. In a similar study conducted by Candan et al. (2019) in the same area, it was noted that writing and drawing on tree trunks were the most common examples of vandalism.

ii. Furniture analysis in Gökçay promenade

The amenities in the Gökçay promenade include a parking lot, a children's play area, a walking path, lighting fixtures, seating groups, pavilions, warning and directional signs, restrooms, and a fountain, among others. There is a total of 18 types of amenities in the area, with 12 of them being well-maintained and 10 of them being sufficient (Table 3; Figure 5).

Table 3. Furniture analysis in Gökçay promenade

	Existence	Maintenance	Adequacy
Playground	Yes	Well-kept	Adequate
Sales unit, buffet	Yes	Well-kept	Adequate
Cafe, restaurant	Yes	Well-kept	Adequate
Walking trial	Yes	Neglected	Inadequate
Parking lot	Yes	Well-kept	Inadequate
Ornamental pool	Yes	Well-kept	Adequate
Lighting elements	Yes	Neglected	Adequate
Fountain	Yes	Well-kept	Adequate
Entertainment center (Wedding salon etc.)	Yes	Well-kept	Adequate
Statues	Yes	Well-kept	-
Trash cans	Yes	Neglected	Inadequate
Sport facilities	Yes	-	Inadequate
Seating elements	Yes	Neglected	Inadequate
Picnic tables	Yes	Neglected	Inadequate
Gazebo etc.	Yes	Well-kept	Inadequate
Theatre	Yes	Well-kept	Adequate
Warning and orientation signs	Yes	Neglected	Inadequate
Toilet	Yes	Well-kept	Adequate

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Figure 5. Playgrounds, parking lots, and sale units in Gökçay promenade

The inadequacy and lack of maintenance of facilities such as children's play areas, sports facilities, seating groups, and parking lots, which people prefer to use for recreational activities, can affect the potential for the area to be preferred by the urban population. Therefore, the facilities to be located should be in harmony with the natural balance of the area and its beauty without disturbing it. In a similar study, Yücedağ & Yelsiz (2022) found that the reasons for people visiting a Promenade include the area providing a calm and peaceful environment, picnicking, nature walks, connecting with nature, and its proximity to the city center.

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Figure 6. Lighting units in Gökçay promenade

The lighting elements in the Gökçay Promenade, including different designs of adjacent lighting elements with approximately 3-meter spacing in some places and the use of different lighting elements throughout the area, create an aesthetically unfavorable appearance for the area (Figure 6). In open green areas and Promenades, inadequate and improper lighting by lighting elements can lead to security issues in these areas (Candan et al., 2019). There is a decorative pool in the center of the area, and there are irregularities on the walking paths within the area, as well as trees and barbecue grills on the sidewalks (Figure 7).



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Figure 7. Ornamental pool, walking trails and parking lot in Gökçay promenade

The Gökçay Promenade features numerous seating groups, picnic units, gazebos, fountains, toilets, and various architectural structures. There is also an amphitheater, a restaurant, and an entertainment center (such as a wedding hall, etc.) where many activities take place in the area (Figure 8).



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Seating groups are important elements that serve significant functions and are frequently used. These elements should be appropriately located and provided in sufficient numbers within the area. In the Gökçay Promenade, it was found that the seating elements were suitable in terms of quality and features but had deteriorated due to heavy use and were no longer usable. Since people visiting the area engage in activities such as nature walks, sports, picnics, and being in close contact with nature, it is essential to have a sufficient number of well-maintained seating elements. Similarly, Yücedağ & Kaya (2017) found that the Gökçay Promenade is visited by people for purposes such as walking, picnicking, and spending time in nature.

Accessibility to a Promenade is proportionally important to its recreational potential. Akten (2003) stated that the more people benefit from an area, and if they do not encounter transportation problems, the recreational potential of that place increases significantly. Due to its proximity to the city center, the Gökçay Promenade is heavily used by the local population. The primary issue is the irregular and insufficient parking areas due to the intense use of the area by people. In a similar study conducted in the Gökçay Promenade (Yücedağ & Kaya, 2017), the inadequacy of the parking lots and the need for appropriately sized parking areas were highlighted.



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Figure 8. Architectural buildings, seating elements, fountain and toilet in Gökçay promenade



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iii. Furniture analysis in Milas promenade

The furniture elements found in the Milas Promenade, which is the subject of the study, include children's playground, sales units, cafeteria, lighting fixtures, seating groups, parking lot, fountain, toilet, garbage bins, sports facility, directional signs, and picnic tables, among others, totaling 15 types of furniture. Of these existing furniture types, 6 are well-maintained, while 5 are considered sufficient (Table 4; Figure 9-10).

Table 4. Furniture analysis in Milas promenade

	Existence	Maintenance	Adequacy
Playground	Yes	Neglected	Inadequate
Sales unit, buffet	Yes	Well-kept	Adequate
Cafe, restaurant	Yes	Well-kept	Adequate
Walking trial	Yes	Neglected	Inadequate
Parking lot	Yes	Well-kept	Inadequate
Ornamental pool	Yes	Neglected	Adequate
Lighting elements	Yes	Neglected	Inadequate
Fountain	Yes	Well-kept	Adequate
Entertainment center (Wedding salon etc.)	No	-	-
Statues	No	-	-
Trash cans	Yes	Neglected	Inadequate
Sport facilities	Yes	Neglected	Inadequate
Seating elements	Yes	Neglected	Inadequate
Picnic tables	Yes	Neglected	Inadequate
Gazebo etc.	Yes	Well-kept	Inadequate
Theatre	No	-	-
Warning and orientation signs	Yes	Neglected	Inadequate
Toilet	Yes	Well-kept	Adequate



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Figure 9. Seating elements, picnic units, pergolas and playground in Milas promenade



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Figure 10. Walking trail, toilet, masjid, ornamental pool, poultrys, orientation signs and trash can in Milas promenade

Milas Promenade, due to its proximity to the city center and easy accessibility, is heavily used by the public, especially on weekends. It serves as a recreational space for children to play, families to have picnics, and for various recreational activities. The area features seating groups,

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picnic units, walking paths, fountains, toilets, a small mosque, and other amenities. Despite the high usage of the area, facilities like children's playgrounds, seating groups, and lighting fixtures are insufficient and poorly maintained in comparison to the size of the area. The absence of suitable walking paths for disabled citizens is also a concern.

c. Comparison of the furniture in promenades

As a result of the comparison of the Promenades in terms of their amenities, it has been determined that Gökçay Promenade has more amenities, better-maintained facilities, and sufficient infrastructure compared to the other Promenades. On the other hand, Milas Promenade, despite its heavy use by the public, has fewer amenities, poorly maintained facilities, and lacks the necessary adequacy in terms of infrastructure (Figure 11).

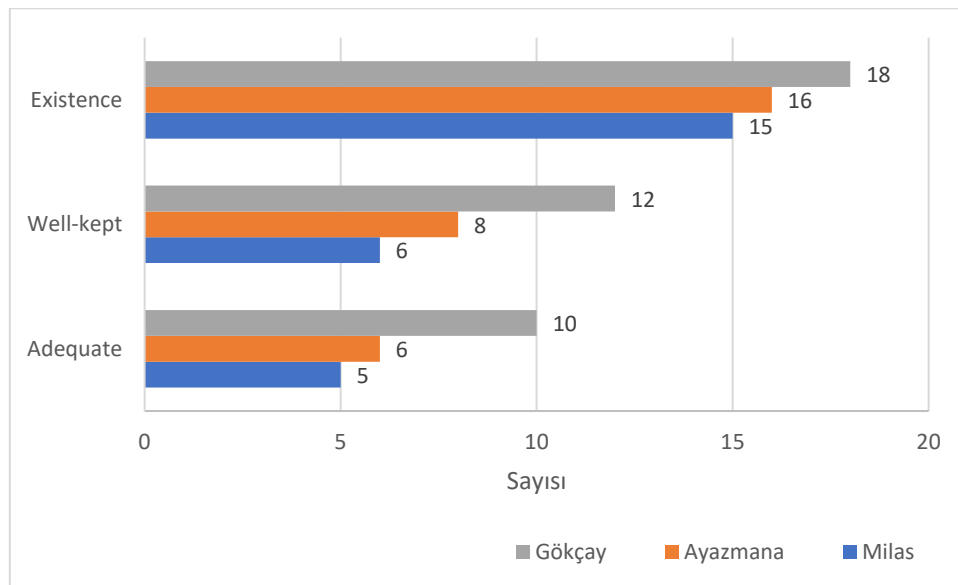


Figure 11. Comparison of promenades in terms of furniture (Total furniture=18)

d. Main plant species in promenades

Plants are one of the most important elements of open-green spaces (Kuter & Erdoğan, 2010). Plant species can transform the areas where they are used into more livable and recreationally potential spaces (Karaşah & Var, 2012), and the selection and appropriate use of plant species in these areas are of great importance (Toprak & Yücedağ, 2022). It has been determined that the main plant species in Ayazmana, Gökçay, and Milas Promenades are either naturally occurring or artificially planted. These species are generally found to mitigate noise pollution, provide shade, and create a pleasant climate in the areas. In Ayazmana Promenade, 9 broad-leaved and 2 needle-leaved (a total of 11) plant species were identified. In Gökçay Promenade, 12 broad-leaved and 3 needle-leaved (a total of 15) plant species were identified, while in Milas Promenade, 6 broad-leaved and 6 needle-leaved (a total of 12) plant species were identified (Table 5).

Table 5. Main plant species in promenades



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Promenades	Latin Name	Natural (N) / Cultivated (C)	Gymnospermae (G) / Angiospermae (A)
Ayazmana	<i>Amygdalus communis</i> L.	C	A
	<i>Castanea sativa</i> Mill.	N	A
	<i>Cedrus libani</i> A. Rich	C	G
	<i>Crataegus monogyna</i>	N	A
	<i>Eriobotrya japonica</i>	C	A
	<i>Morus alba</i> L.	C	A
	<i>Pinus nigra</i> L.	N	G
	<i>Platanus orientalis</i> L.	C	A
	<i>Prunus cerasifera</i>	C	A
	<i>Robinia pseudoacacia</i> L.	C	A
<i>Tilia grandiflora</i> L.	C	A	
Gökçay	<i>Acer negundo</i> L.	C	A
	<i>Amygdalus communis</i> L.	C	A
	<i>Cedrus libani</i> A. Rich	C	G
	<i>Juglans regia</i> L.	C	A
	<i>Morus alba</i> L.	C	A
	<i>Picea pungens</i> Engelm.	C	G
	<i>Pinus nigra</i> L.	C	G
	<i>Platanus orientalis</i> L.	C	A
	<i>Populus alba</i>	C	A
	<i>Populus canadensis</i>	C	A
	<i>Prunus cerasus</i> L.	C	A
	<i>Pyracantha coccinea</i> M. Roem.	C	A
	<i>Robinia pseudoacacia</i> L.	C	A
	<i>Salix babylonica</i> L.	C	A
<i>Yucca filamentosa</i> L.	C	A	
Milas	<i>Abies cilicica</i> L.	C	G
	<i>Buxus sempervirens</i> L.	C	A
	<i>Cedrus libani</i> A. Rich	C	G
	<i>Juniperus sabina</i> L.	C	G
	<i>Liquidambar orientalis</i>	C	A
	<i>Picea pungens</i> Engelm.	C	G
	<i>Pinus nigra</i> L.	C	G
	<i>Populus canadensis</i>	C	A
	<i>Pyracantha coccinea</i> M. Roem.	C	A
	<i>Rosa canina</i> L.	N	A
	<i>Salix babylonica</i> L.	C	A
	<i>Taxus baccata</i>	C	G

4. CONCLUSION and SUGGESTIONS



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In this study, it has been revealed that Gökçay Promenade has more facilities, better maintenance, and is more sufficient compared to other Promenades. Gökçay Promenade, being one of the most popular Promenades for the residents of Isparta due to its proximity to the city center, should consider removing the trees along the walking paths, especially if they hinder visitors' use of these paths. Additionally, measures should be taken due to the proximity of decorative fountains to the children's playground. One of the main shortcomings of the area is the insufficiency of picnic units and seating groups, which are essential for the basic purpose of picnicking for visitors. The different types of lighting elements used in the area were not found aesthetically suitable. Maintenance efforts in the area should be increased.

For Ayazmana Promenade, it was found that there is a lack of lighting elements and seating groups, and the road-side parking system is irregular and insufficient. Recommendations for improvement include installing lighting elements in a homogeneous distribution within the area, maintaining and repairing existing seating groups, increasing their numbers, and developing a specific design for the parking area, separating it from the roadside and expanding it. The area where historical (monument) Anatolian chestnut trees are located should be designated as a special zone, walking routes should be prepared, picnic units should be removed from that area, and information and warning signs for visitors should be placed. Additionally, scenic viewpoints should be identified.

Milas Promenade, which is intensively used by the public for activities such as nature walks, picnics, relaxation, and various recreational activities within the forest ecosystem, has fundamental deficiencies in terms of lighting elements, trash cans, and seating groups. Regular cleaning and maintenance procedures are necessary to address issues related to cleanliness. In forest ecosystems, the use of recreational resources is primarily due to their natural and aesthetic values. Therefore, in such areas, both infrastructure and superstructure arrangements should be made in a way that recreational activities do not disrupt the natural structure of the environment. Sustainable use of natural resources requires the improvement of infrastructure and superstructure in the studied Promenades, diversification, and an increase in recreational activities. This can increase the recreational potential of these areas.

It was found that the furniture elements in the studied areas are damaged by the public during their use. To prevent such damages, the public should be informed and warned through various communication channels. Measures should be taken to prevent vandalism damages to the furniture elements in the areas. In landscape design and implementation projects, elements that hinder human use should not be included in sidewalks and walking paths. In future botanical design projects for the studied areas, the use of plant species with high aesthetic value and plant diversity will increase the recreational value of the areas.

In conclusion, it is crucial for the future planning and management of the natural resources in the three Promenades, which are of great importance to the city of Isparta, to carry out periodic arrangements, maintenance, control, and protection work in the areas. Functional and managerial new approaches should be established and implemented as soon as possible.

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DIGITAL APPROACH TO DOCUMENTING CULTURAL HERITAGE DYNAMICS IN HASANKEYF

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ABSTRACT

The history of humanity has a rich and diverse history with numerous civilizations and cultures. Cultural heritage sites preserve this heritage as an urban memory that can be passed on to future generations. However, rapidly increasing urban development, unpredictable natural disasters and complex socio-political dynamics are serious risks that threaten the sustainability of these heritage assets. Hasankeyf, with its thousands of years of history and hundreds of archaeological sites, has been one of the cultural treasures under risk. The major change in the city due to the Ilisu Dam project has aroused widespread repercussions at the international level and it has reminded that the preservation of cultural assets should include not only tangible assets, but also historical memory and knowledge. Therefore, documenting and archiving historical and cultural assets in detail is crucial before their permanent transformations. In this study, photogrammetric models of Hasankeyf were created with Metashape software using old drone images. Then, a photogrammetric model of the area was created using the latest drone images in order to make a process evaluation. Then, the transformation of Hasankeyf was examined through the models obtained and the transformation was visualized. The interaction between cultural heritage and technology has gained great importance in preservation studies in the digital age of rapidly developing technology. This study highlights the possibilities that digital technologies can present in the preservation of cultural heritage and demonstrates the increasing necessity of documenting historical values. It also provides a framework for documentation of similar historical heritages.

Keywords: Cultural Heritage, Digital Tools, Photogrammetry, Hasankeyf, Türkiye.

1. INTRODUCTION

Cultural heritage is the totality of tangible and intangible elements that reflect the identity, history and cultural values of a community, people or nation. Tangible and intangible cultural heritage includes aesthetic-artistic, historical-documentary, symbolic, socio-economic, religious and spiritual, and even political values. In addition, cultural heritage is the manifestation and proof of the existence, characteristics and cultural continuity of human beings, societies and cultural groups that make up society (Halaç & Öğülmüş, 2021). The conservation of cultural heritage is critical for passing on the history, identity and cultural values of societies to future generations. However, numerous factors such as globalization,



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rapid urbanization, environmental degradation and economic pressures make cultural heritage conservation challenging and complex. In these challenging circumstances, digitalization is often proposed as a solution. With the rise of digital technologies, there is a growing interest in the idea that cultural artifacts and structures can be preserved digitally, creating a wider accessibility and even a more active role for society in this process. In addition, digital data play an important role in the preservation and sustainability of cultural heritage, as they serve as documents. The opportunities offered by digitalization are not only in document creation. Digitalization also includes features such as documentation and research, digital archiving and cataloging, global outreach and education, virtual tourism and observation, digital restoration and simulation, community engagement and crowdsourcing, benchmarking and tracking, digital exhibitions and museums, and many other interactive experiences that help carry cultural heritage to future generations.

Developments in the technologies used in the documentation and representation of cultural heritage have forced experts working in this field to think about the effects of technology, its benefits and the resulting possibilities. The digital documentation obtained with this technology allows the production of a simplified model of the object that allows the transfer of the necessary information and contains sufficient information, instead of the model produced by traditional methods, which consists of drawings that define the geometry of the object and pass through reference sections that divide the space horizontally and vertically. Such representation methods not only allow the direct extraction of metric information, but also facilitate our understanding of the object while forcing us to select the most important parts to simplify the object (Korumaz et al., 2011). In this context, two-dimensional and three-dimensional digitization of heritage data in today's studies is becoming a common practice in cultural heritage areas. This process, which can be explained by the term "digital heritage", is used intensively by international institutions such as UNESCO, which have studies in the field of cultural heritage, and it is intended to reveal the cultural values of societies together with the principle of digitization and to be presented to us as digital information (Töre, 2018).

Documentation in cultural heritage should be based on the current state and historical past of the building, its structural layout and deterioration rates, as well as material analysis, and should also include the features that determine the morphology of the building and its current state and the interventions it has undergone over time (Tucci, 2009). In recent years, developing documentation techniques offer fast, reliable and cost-effective solutions in many different fields. When the studies in the literature are examined, it is seen that photogrammetry, which is one of the most important methods of digital documentation techniques and used in this study, can be used for determining coastal areas (Gonçalves & Henriques, 2015), monitoring land use change, determining urban areas, monitoring forest destruction, green area detection, flood analysis, volume calculations (Ulvi, 2018; Kaya, et al, 2019; Minařík & Langhammer, 2016), modeling of historical monuments (Şasi & Yakar, 2018; Galantucci & Fatiguso, 2019; Yılmaz, et al., 2008), cultural heritage sites (Yastıklı, 2007; Hassani, 2015; Dostal & Yamafune, 2018), structural analysis of historical buildings (Kutlu, et al., 2023; Barille et al., 2016).

With its history, Hasankeyf has the characteristics of a museum city with its immovable cultural heritage, multi-layered historical structure, topographical features and the current conditions it has reached today. In this study, it is aimed to reveal the possibilities provided by digital tools in protecting cultural heritage and documenting and analyzing the change of cultural heritage on an urban scale through Hasankeyf.

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In this context, photogrammetric models of Hasankeyf were created with Metashape software using old drone images. Subsequently, a photogrammetric model of the flooded old settlement area was created using the most recent drone images in order to make a process evaluation. Hasankeyf's transformation was analyzed through the models obtained. The fact that the models provide an opportunity to address the city in a holistic manner has allowed to clearly see the transformation of the historical area of Hasankeyf and the transformation of the city in the process has been revealed on an urban scale.

2. MATERIALS and METHODS

2.1. General information about Hasankeyf

Hasankeyf, formerly known as Hisn-ı Keyfa, is located in the province of Batman in the Southeastern Anatolia Region of Turkey. "Hisn-ı" The Arabic "Keyfa" is Syriac and both mean "rock". Hisn-ı Keyfa also means "Yağın Rock Peak" (Umar, 1993). The history of the district dates back to approximately 12,000 years ago. Hasankeyf, which has been home to many civilizations in history, contains rich cultural heritage structures. According to records dated 1530, Hasankeyf, which was under Ottoman rule, had 4 mosques, 11 zawiya, 30 masjids, 2 caravansary and 4 baths (Baluken, 2016: 310-335). Hasankeyf was declared a natural protected area by the Ministry of Culture and Tourism in 1981 (Çoban, et al. 2017; Yeşil and İnal, 2019; Öncül and Alpaslan, 2014; Öztürk, et al., 2021). The city is accessible to Batman and Mardin from the west and Midyat and Gercüş from the south (Figure 1). Hasankeyf, which is an important tourism center with its historical and natural beauties, is visited by many local and foreign tourists.

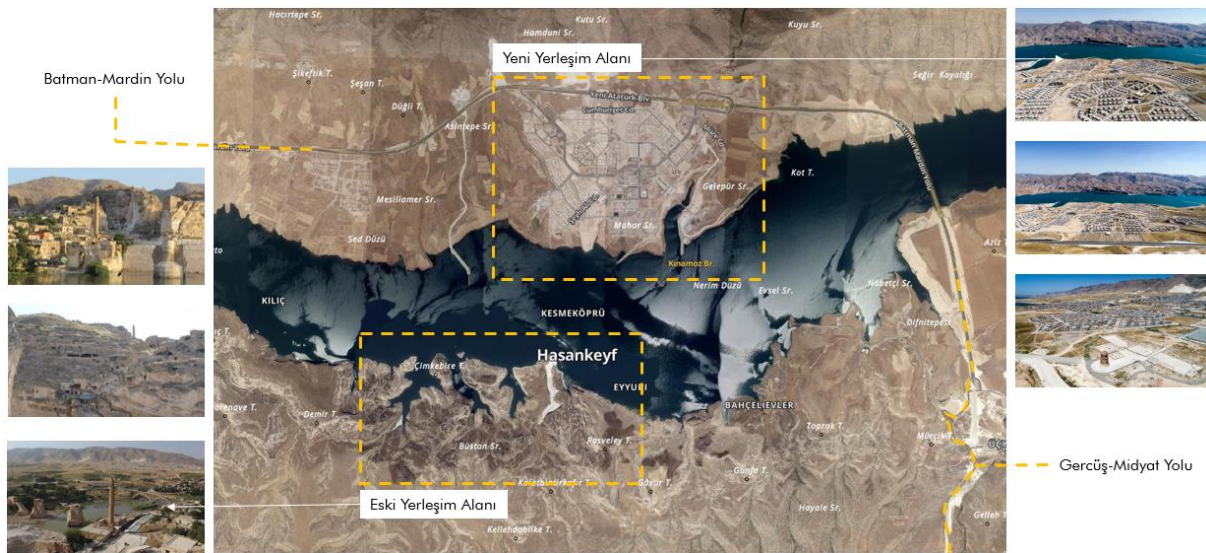


Figure 1. Hasankeyf city boundaries and views (Edited from General Directorate of Mapping)

The geological structure of Hasankeyf consists of cave dwellings created by natural and man-made processes due to its limestone structure that can be easily carved. The appearance of its rocky terrain with valleys and hills formed by natural factors over thousands of years is one of its most important features (Arik, 2003: 13). While excavations were continuing in Hasankeyf, located on the banks of the Tigris River, the construction of the Ilisu Dam Project began. In May 2020, as a result of the dam built on the Tigris River, the historical settlement of Hasankeyf



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was flooded. For this reason, rescue excavations and works for the transportation of historical artifacts were carried out in Hasankeyf before it was submerged under the waters of the Ilisu Dam. Protection and transportation works were carried out in cooperation with the General Directorate of State Hydraulic Works and the General Directorate of Cultural Heritage and Museums (Sevgi & Yılmaz, 2020). The historical buildings moved to the archaeopark area organized in the new Hasankeyf settlement area were prevented from being flooded.

2.2. Data Collection

Data collection method is the research technique used to obtain data that will bring the research subject to the conclusion. Depending on the research topic, data collection can be done in various ways such as document analysis, questionnaire, interview, observation, experiment (Symon & Cassell, 1998; Yıldırım, 1999).

Due to the relocation of historical buildings to the new settlement area in Hasankeyf district, data collection studies on the old city views were carried out first. Extensive online publications and research on image acquisition were conducted. Following the acquisition of data on the old city, data research on the new city views was carried out. Especially the existing images obtained from unmanned aerial vehicles (drones) provide important data for the city as a whole. The data obtained was used as a base in the study in order to reveal the old and new urban texture of the region.

2.3. Digital approach to documenting cultural heritage

Two stages are very important in the cultural heritage process. The first one is data collection and the other is the decision-making process. The data collection phase is a process that also affects the decision-making process and should be followed carefully. According to Boehler and Heinz (1999), the decision-making process in the study of cultural heritage involves first deciding what to document and then selecting the appropriate methodology in consultation with experts from other disciplines.

With the developing technology, the methods used in documenting historical values are also changing and developing. The use of modern techniques in historical buildings and cultural heritage studies has provided great convenience over time compared to traditional methods (Balçı, 2022). Although these methods have diversified over time, the margins of error have gradually decreased, time savings have increased, manpower burden has decreased, and it has progressed digitally to 3D documentation (Masciotta et al., 2021; Reunanen et al., 2015; Korumaz et al., 2011). It is easier, faster and more precise to take detailed measurements, make drawings, take photos and videos, and obtain 3D data from drawings. In addition to all these, modern techniques provide the opportunity to store the obtained precise and visually rich data in a digital environment for a long time.

In this study, photogrammetry, one of the 3D modeling techniques enabled by today's technology, was used. Photogrammetry means measuring with the use of photos and enables the creation of a 3D model from photographs (Gienko & Terry, 2014; Yılmaz, et al., 2007; Şenol, et al., 2021). In general, photogrammetry is a science in which reliable information about objects and the environment is obtained as a result of the recording, measurement and interpretation of photographic images shaped by the rays emitted from the objects and the environment they form, and the electromagnetic energy they emit (Figure 2). There are different photogrammetric classifications such as terrestrial photogrammetry and aerial photogrammetry



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according to the technique of obtaining images. In this study, aerial photogrammetric technique was used. Aerial photogrammetry is a technique used to create maps, models, and measurements from aerial photographs. It involves capturing overlapping aerial images and using them to extract 3D information about the terrain or objects of interest.

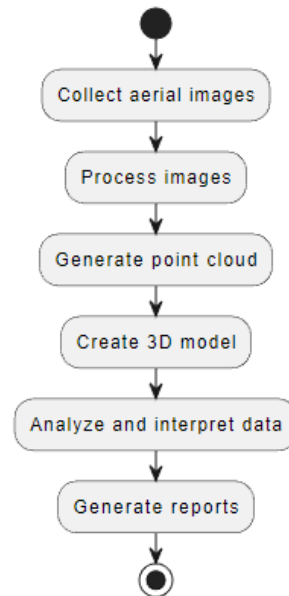


Figure 2. Process flow chart of 3D photogrammetric model production with aerial images used in the study

3. FINDINGS

In this study, Hasankeyf data were analyzed in two different periods, before and after 2019, with reference to the water filling of the Ilisu Dam and the hydroelectric power plant in August 2019. Photogrammetric models were created for both periods in order to ensure an effective and holistic analysis of the periods. The cultural heritage data were analyzed through the digital three-dimensional models created in the study. These models were created with real measurements using the program's depth detection algorithm.

In order to present the change of the region with digital tools, the change of the old and new settlement areas of Hasankeyf over time was mapped on 2D Google Maps. Prior to 2019, a 3D photogrammetric model of the area was created in addition to the 2D map. The model indicates the locations of the cultural heritage structures in the area at that time. In the period after 2019, an updated photogrammetric model was created to show the condition of the flooded old settlement area. In the study, a model was also created for the new settlement area in the city, where a process of cultural heritage relocation was managed, and the new locations of the relocated cultural heritage were also indicated.

3.1. Hasankeyf – Before 2019

In the study, existing drone images were used to create a model of the Old Hasankeyf settlement area. The photogrammetric software program Metashape (developed by Agisoft) was used to obtain the images. The program has algorithmic features that can detect depth from the acquired



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images. In order to create a photogrammetric model of the Old City of Hasankeyf, 174 photographs were added to the program.

In order to perceive depth from photographs, they must be overlapped and taken from different angles. Otherwise, the program cannot identify and align the images. The program aligned 138 out of 174 images obtained for Old Hasankeyf. After the alignment process, a model is formed from the point cloud. Upon completion of the alignment process, build dense cloud is created. The build dense cloud allows to create a denser point cloud than the base points that can be aligned from the photographs. With the creation of the dense point cloud, the "built mesh" process of converting the points into meshes was realized. The textures of the defined photographs were transferred to the model consisting of networks by "build texture" and "build tiled model" operations. Thus, the Old Hasankeyf model creation process was completed (Figure 3).

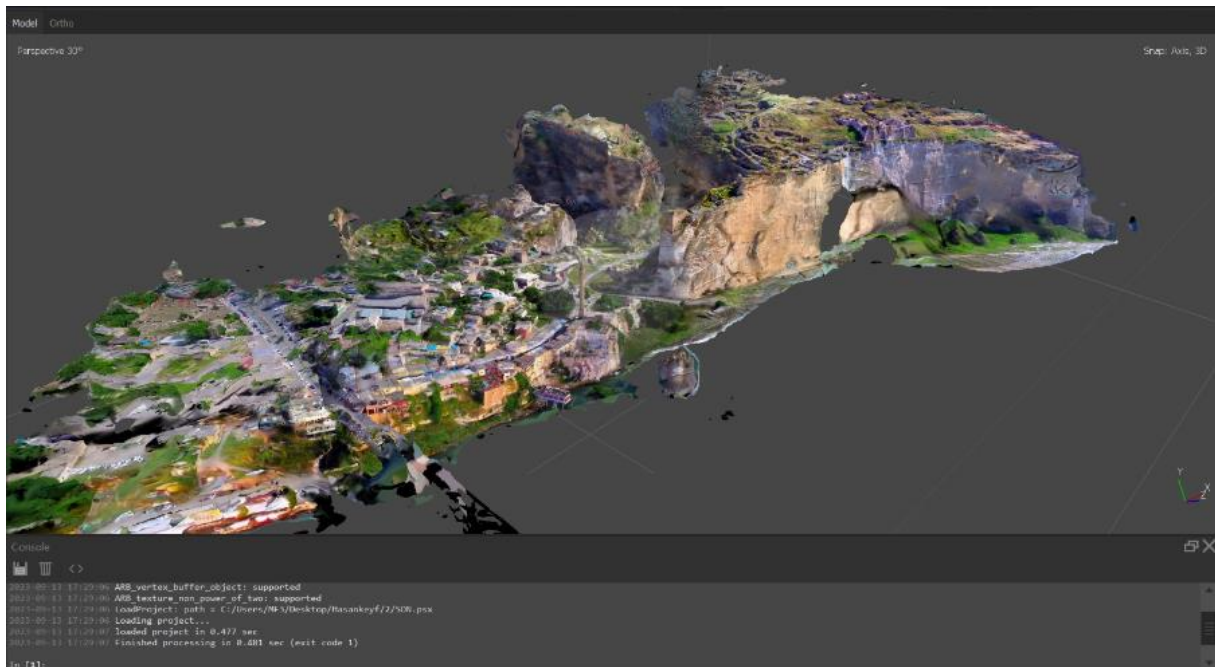


Figure 3. Photogrammetric model produced within the scope of the study for Hasankeyf old settlement area

At the beginning of the 21st century, the Ilisu Dam Project created the need for a new settlement area for Hasankeyf. This area was evaluated as the foothills of the mountain in the northern direction of the old settlement area and across the river. The new settlement area, which has a flatter terrain compared to the old settlement area, started to be built quickly after the decision was made (Figure 4).

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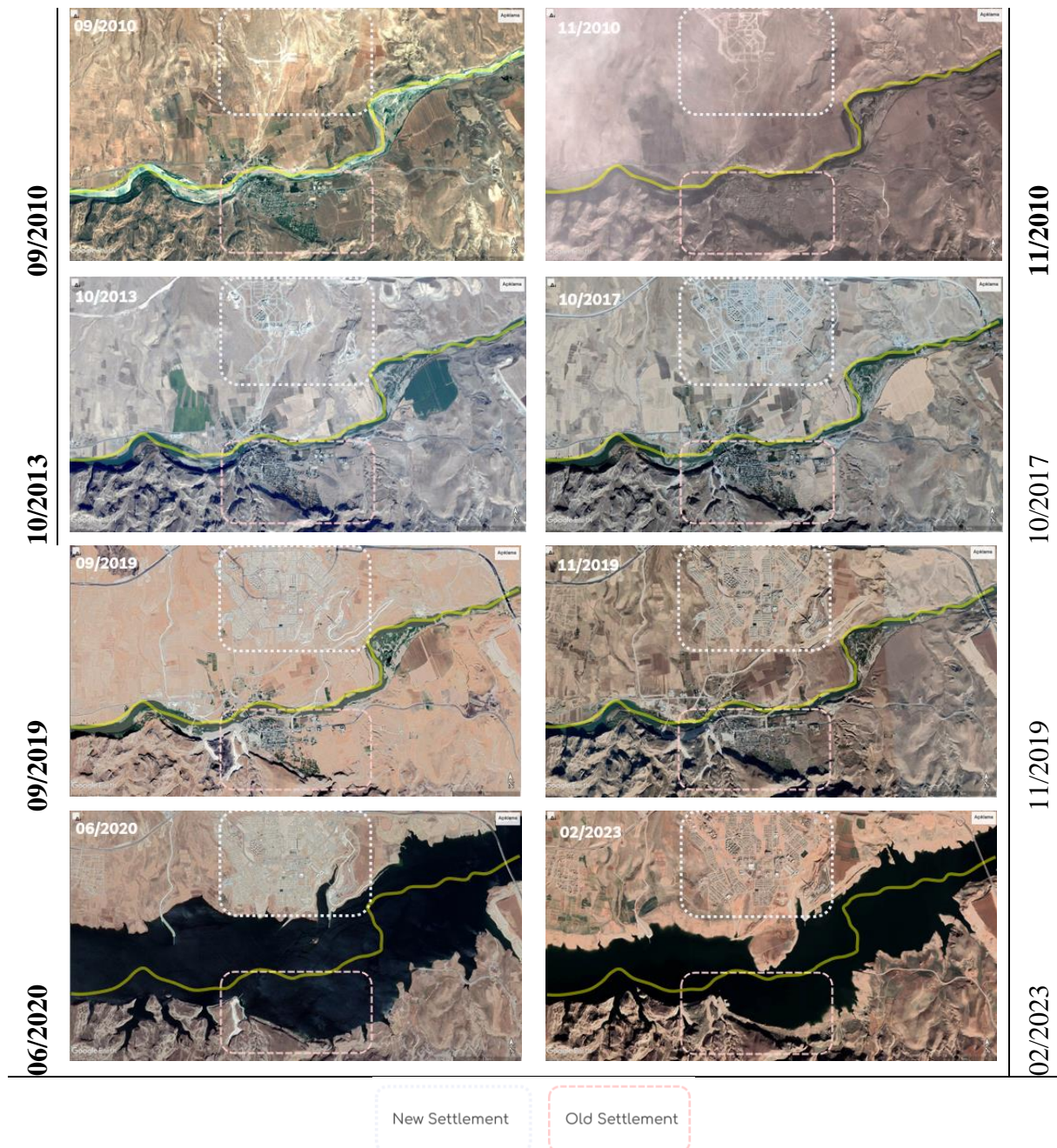


Figure 4. Historical development of Hasankeyf settlement area

3.2. Hasankeyf – After 2019

In order to make a comprehensive assessment of the old and new settlement areas, models were created for both the current situation of the old settlement area and the new settlement area of Hasankeyf after 2019.

The flooded model of the old settlement area was created with data from 2021. 133 photographs of the settlement area were added to the program and the program recognized and aligned all



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these photographs. After the alignment process, the dense point cloud generation was performed and the process was completed by generating a model consisting of meshes (Figure 5).

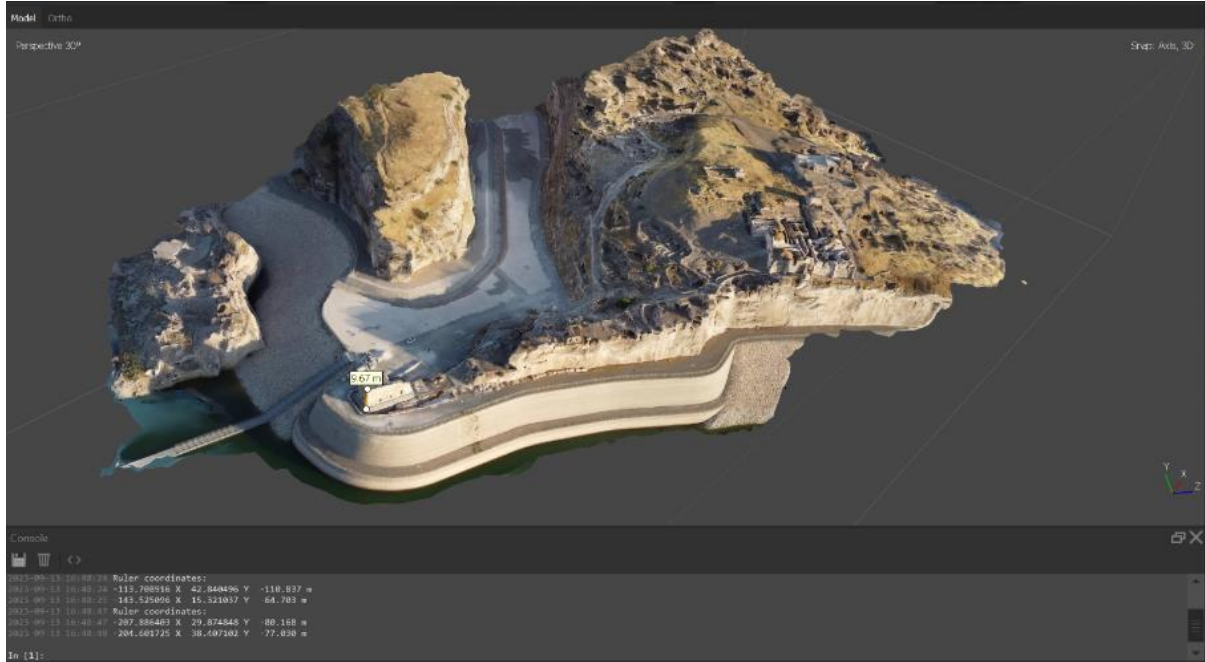


Figure 5. Hasankeyf eski yerleşim alanının su altında kalan durumunu gösteren fotogrametrik model

With the flooding of the Hasankeyf settlement area, the issue of relocation of both civilian life and cultural heritage has arisen. Immovable cultural heritage sites known as Zeynel Bey Tomb, Artuklu Bath, Imam Abdullah Zawayah, Kızlar Mosque, Middle Gate, Süleyman Han Mosque and Er Rızk Mosque were moved to the Archaeopark Cultural Area due to the risk of being submerged under the Ilisu Dam and Hydroelectric Project (HES). This new settlement area is located approximately 2 km north of the old settlement area from a bird's eye view. As part of the study, a photogrammetric model of the area was created in order to see the legibility of this area and the new locations of the historical buildings on an urban scale. To create the model, 283 photographs were used and the program created a photogrammetric model of the area by identifying 271 of these photographs (Figure 6).



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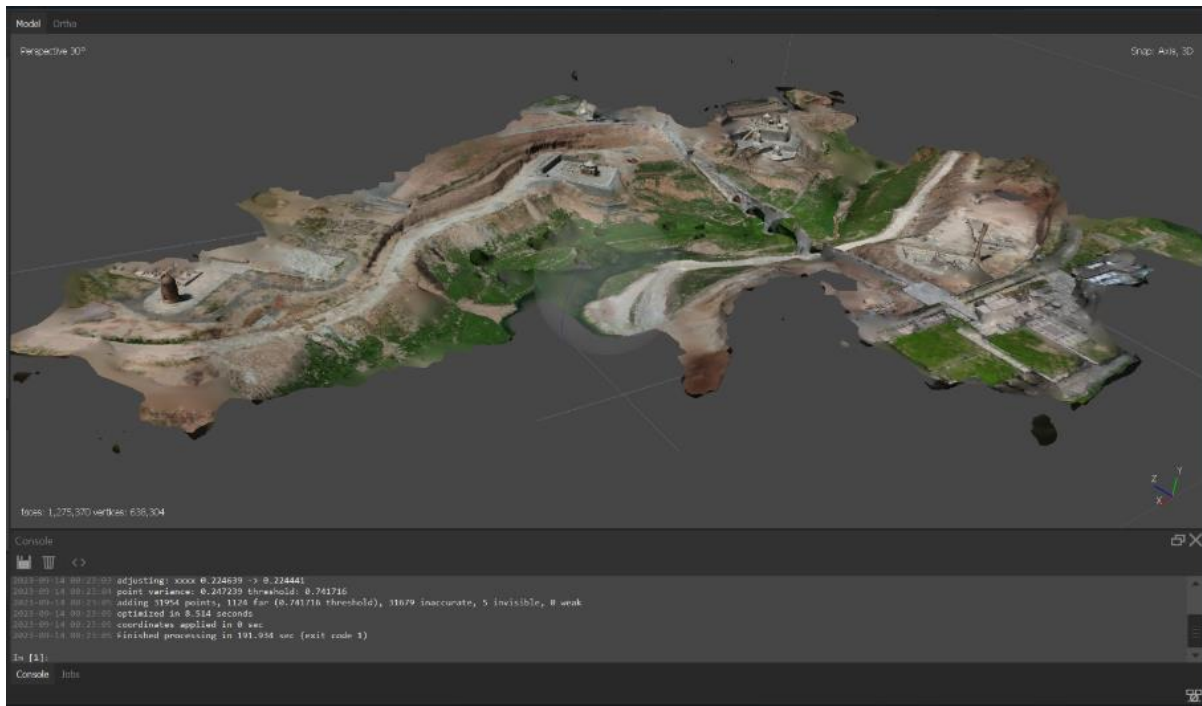


Figure 6. Photogrammetric model of Hasankeyf new settlement area and Arekopark area

4. Evaluations and Discussion

The tools used in the conservation and documentation of cultural heritage are changing and evolving with the development of technology. The method of photogrammetry used in this study has spread rapidly with the development of photographic techniques and computer software in the mid-20th century. Considering the identification process of the photographs used in photogrammetric model making, the process may not be a single step, and the program may not be able to align all the photographs taken. Therefore, it may be necessary to take new photos in the field. Photographs that cannot be identified by the program are detected by the program interface. New images should be taken from the same or similar angle using the "overlap" technique, paying attention to the previously identified image.

The new images can be aligned with the previously taken images by adding them back into the program. The problem with unidentified photos is usually that the images are not of similar daylight, size, and resolution quality. The visibility of the surfaces in the camera angle is one of the most important factors of the model quality. It is recommended that images be taken before hours of intense shade or intense sunlight. The 3D model obtained by photogrammetry is dimensional. However, it is recommended to check the dimensions of the models against an object whose real dimensions are known and to rescale them if necessary. One of the most important advantages of a scaled model is that important data measurements for surveys required for conservation and documentation studies can be obtained from 3D models.

When Hasankeyf is considered through the models created within the scope of the study, the transformation of Hasankeyf can be clearly seen. When this transformation process is evaluated within the scope of the models created;

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- Examining Figure 7, it can be seen that old Hasankeyf, where the historical urban fabric is integrated with socio-cultural life, is completely submerged, while a part of Hasankeyf Castle is still above the water, can still be visited, and contains important cultural structures.
- Examining Figure 8, it can be seen that the original stairs that provided access to the castle and the area where the caves were located, which were among the first settlement areas, were covered with fill material in order to control the water from the dam.

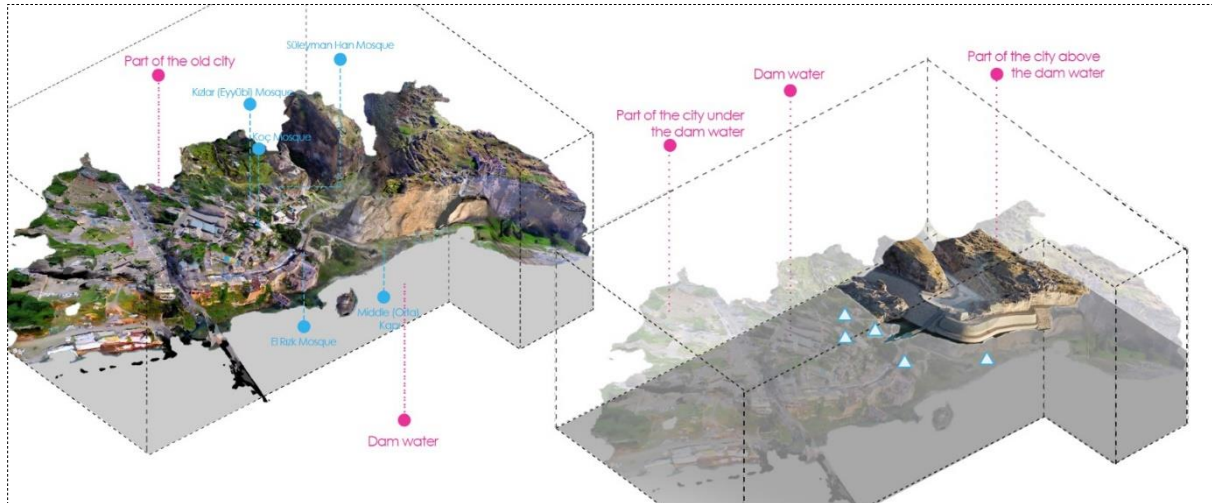


Figure 7. Historical Hasankeyf settlement and flooded areas

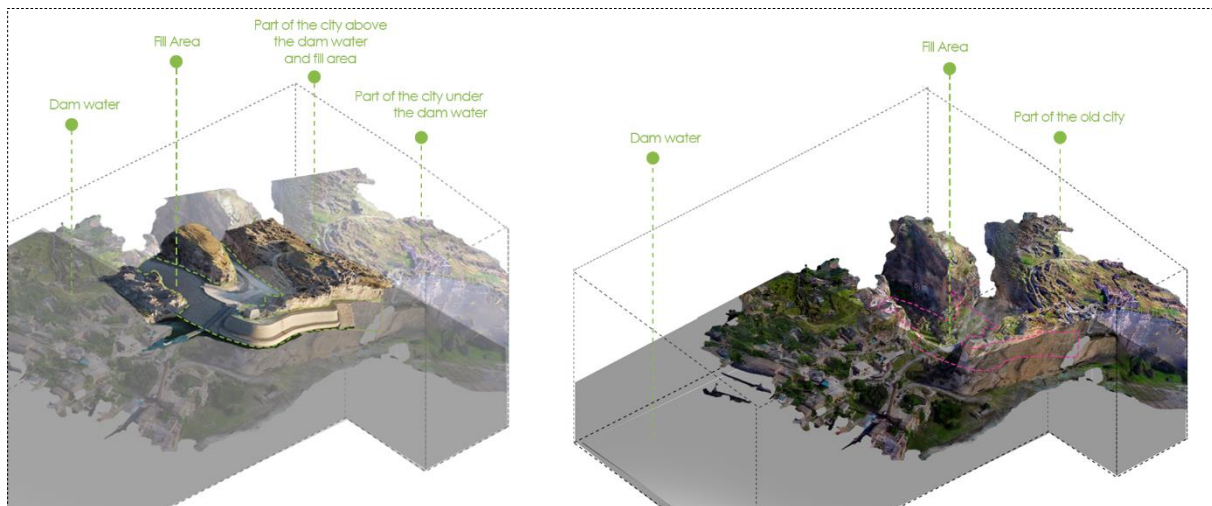


Figure 8. Regional locations of the embankment operations for the dam

- Examining Figure 9, the Archaeopark Cultural Area can be seen where the historical buildings that will be flooded by the Ilisu Dam have been relocated. The urban life and cultural heritage areas, which form an integrity with the civilian life of Hasankeyf, are located together in the new settlement area. The Archaeopark area has become an area that ensures the protection of individual structures.

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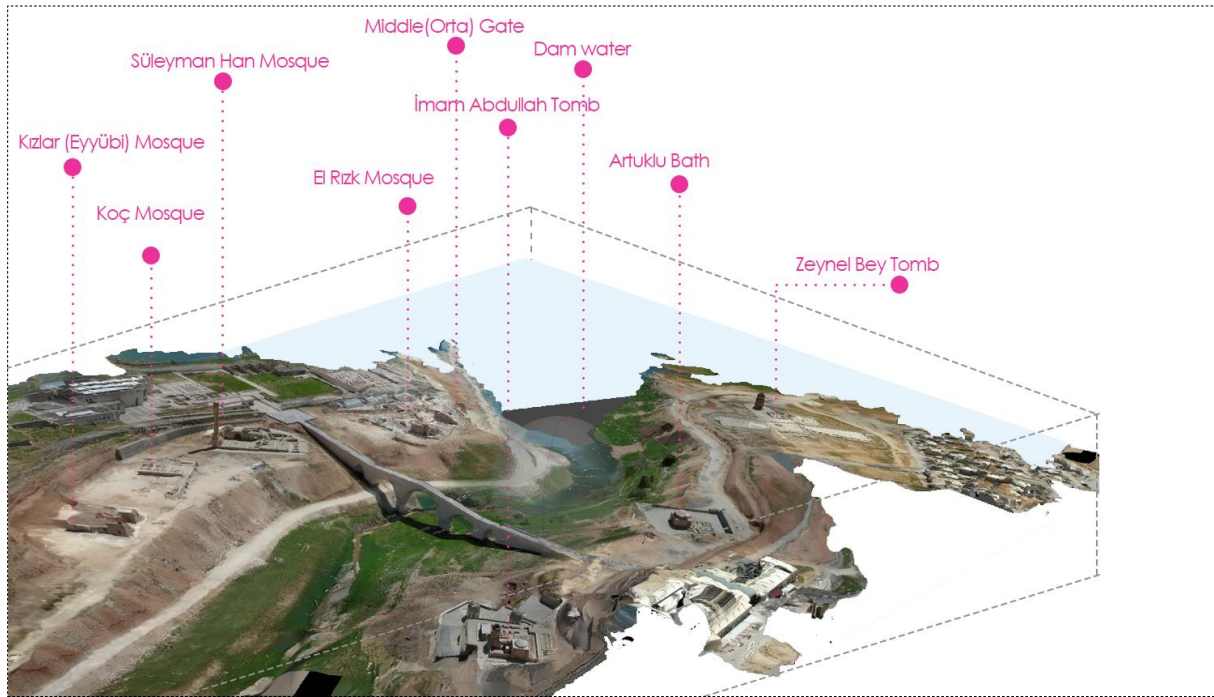


Figure 9. Photogrammetric model showing Hasankeyf new settlement area and Archaeopark Cultural area

Hasankeyf is a settlement with a rich historical and cultural background. It has historical buildings, caves and ancient ruins. For this reason, submerging under water also means losing the eye-catching effect of the cultural heritage. Although the tangible cultural heritage has been transferred to the new settlement area, the intangible cultural values have not been transferred. It can be said that in a region where abstract cultural values and feelings of belonging cannot be transferred, the original values of the region are also lost, and it will take many centuries to recreate these values in a new settlement area.

Although large-scale infrastructure projects such as the Ilisu Dam create a cycle in terms of resource production and consumption, their environmental impact is quite high. Such large-scale infrastructure projects can often cause conflicting emotions and different opinions. In this context, it is necessary to ensure the sustainability of all the physical, social and cultural values in the area without ignoring them when dealing with large-scale infrastructure projects, which are also a current topic of debate.

5. CONCLUSION

One of the primary rationales for integrating the concept of digitization with cultural heritage is the belief that sustainable documentation can be achieved by transferring heritage data requiring preservation to a digital medium. Consequently, this study has shed light on the significant role that digital methodologies can play in documenting the complex cultural heritage dynamics of Hasankeyf, a site of historical importance yet faced with various contemporary challenges.

Researchers are able to create a comprehensive digital archive that captures not only the physical elements of the heritage site but also its socio-cultural and historical dimensions through a multi-faceted approach incorporating digital mapping, 3D modeling, and interactive



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databases. Digital tools discussed, ranging from GIS to drone-based photogrammetry, offer scalability in modeling and analysis, thus presenting a significant opportunity for the preservation or reconstruction efforts of Hasankeyf. These technologies also democratize the documentation process, allowing the community to actively participate in and contribute to the discourse surrounding their own cultural heritage.

While the digital approach offers numerous advantages, its limitations should not be overlooked. Technical constraints, resource limitations, and issues of digital preservation must be addressed to ensure that the generated data remain accessible and interpretable for future generations. Ethical concerns related to data ownership, representation, and inclusivity also necessitate further research. As we advance in the age of digital innovation, the need to leverage these technologies not merely as repositories of information but also as dynamic platforms for storytelling, dialogue, and mutual understanding becomes increasingly important. This study takes a significant step in preserving its rich history for future generations by documenting Hasankeyf's cultural heritage through a digital approach. At the same time, it lays the groundwork for data sets intended for future initiatives in heritage conservation, urban transformation and redevelopment.

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DEFINING SOCIAL SUSTAINABILITY: A STATE OF ART REVIEW

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ABSTRACT

"Sustainability" is a concept that emerged with the aim of meeting the needs of future generations without compromising the needs of present generations and has become a global implementation plan through international agreements towards the end of the 20th century. Economic growth, social development, and effective environmental conservation are three essential elements that cannot be ignored for sustainable development. While environmental and economic sustainability entered the literature during the same period, the definition of social sustainability followed a variable process. It evolved from a definition that focused on meeting basic human needs such as food, shelter, education, and health to a more differentiated and complex dimension in terms of indicators. This evolution is essential for sustainable development, which aims to ensure the transmission of a sustainable future to the next generations. The concept of social sustainability has its roots in the social sciences and has reached an ever-expanding research area with undefined boundaries. Finding a common definition and comprehensive framework for social sustainability in the literature has become challenging due to the diverse approaches taken by various disciplines since the 19th century. In this context, the purpose of this article is to present the definitions of "social sustainability" attempted by various disciplines and provide a descriptive framework. The study compiles and presents different definitions of social sustainability that have been proposed since the 19th century, aiming to offer a comprehensive perspective on the concept. The study employed a literature review method to gather data.

Keywords: Social Sustainability, Social Sustainability Definitions, Architectural Social Sustainability.

1. INTRODUCTION

With the increasing population in the 19th century, the utilization of natural energy resources increased. In the 20th century, advancing technology rapidly depleted the earth's natural resources, leading to a significant increase in environmental issues. In this context, intensive efforts have been initiated to find solutions that consume resources minimally, protect the environment, and ensure sustainability (Mengi and Algan, 2003). The concept of "sustainability," which is included in the "World Conservation Strategy" document adopted by I.U.C.N in 1982, entered the architectural literature with the publication of the book "Ecological Construction (Ökologisches Bauen)" in 1982 by the directives of the German Ministry of Environment (Özbayraktar, 2017). In this book, information about natural and artificial



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environments, the functioning of active and passive systems, and the main approaches of ecological design were presented through illustrations and graphics. This book has been referred to as the "Neufert" of ecological architecture (Tönük, 2008). Up until 1987, the prevalent development approach worldwide, which disregarded the environment and focused on society and economy, was replaced by the concept of "sustainable development," as first defined in 1987 through the report "Our Common Future," also known as the Brundtland Report, prepared by the World Commission on Environment and Development. This report shapes the environmental issue within the framework of the interconnected relationships among poverty, inequality, population growth, and environmental degradation. It proposes a new development model that is environmentally compatible for all countries and introduces the concept of "sustainable development" (World Commission on Environment and Development, 1987). Sustainable development, which was introduced in 1987 and rapidly entered the architectural literature, is defined as sustainable architecture in the architectural context and is achieved through three fundamental principles:

- Conservation of resources; reduction, reuse, and recycling,
- Life cycle,
- Human-centered design (Kim and Rigdon, 1998).

In 1999, the International Council for Research and Innovation in Building and Construction (C.I.B.) provided a detailed explanation of the fundamental principles of sustainable architectural design, encompassing three main dimensions: economic, environmental, and social aspects (C.I.B., 1999). Despite efforts to create a shared understanding of the three main components defined for sustainable architecture in the literature (Sachs, 1999; Williamson, 2007; Pressoir, 2008; Çahantimur, 2007; Becker, 1999; Sakınç, 2010; Kohler, 1999), it is observed that there is no common definition of social sustainability in the literature, and it has evolved over time with different scopes and perspectives.

2. SOCIAL SUSTAINABILITY

Social sustainability, broadly defined, encompasses the conservation and augmentation of societal circumstances conducive to fulfilling human requirements and upholding environmental viability. Its core purpose lies in the judicious utilization of natural assets by both current and forthcoming generations (Çahantimur, 2007). A multitude of contrasting interpretations pertaining to social sustainability abound. These elucidations typically center on well-defined objectives like impartial access to opportunities and resources, alongside an equitable apportionment of advantageous and detrimental consequences (McKenzie, 2004). They underscore the significance of democratic frameworks that guarantee entry to decision-making mechanisms, coupled with communal interactions that foster the accumulation of social resources on localized and broader planes (Bramley and Power, 2009). Moreover, the interpretations presented underscore the significance of inclusion, tolerance, and the underlying societal framework that bolsters unity within thriving societies, with the aspiration that these societies attain elevated levels of communal welfare (Anand and Sen, 1994; Sen, 2013; Opp, 2016; Shirazi and Keivani, 2017). From this vantage point, 'community' is delineated as clusters or networks interlinked by relatively enduring social bonds formed around shared affiliations or interests (Marshall, 1998). Within local communities, in-person interactions emerge as the elemental components fostering interconnection and unity (Goffman, 1972). When scrutinized



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through the lens of social sustainability literature, it becomes evident that the criteria and delineations in this domain remain incomplete within both architectural practice and literature (cf. Woodcraft et al., 2012; Opp, 2016). To be sure, the spatial dimensions entwined with social sustainability have been explored within the realm of architecture. To illustrate, Mumford's 1953 discourse on "urbanity" encapsulated the praiseworthy facets of urban existence, encompassing a sophisticated collective urban life and individual gratification. Antecedent viewpoints on "urban life," such as Park's (1915) treatise on "Human behavior in the urban environment" and Wirth's (1938) exploration of "Urbanism as a way of life," are notable. Subsequently, in the 1960s, Jane Jacobs made seminal contributions concerning "vitality" and "successful neighborhoods," particularly in the context of architecture. These ideas have more recently manifested as the concept of "livability" (James, 2015). The fundamental objective of social sustainability resides in probing the dynamics between communities and their proximate surroundings. In essence, social sustainability seeks to comprehend the interplays, correlations, and repercussions between individuals and the spaces they inhabit, striving to harmonize and enhance these connections in a sustainable manner. It accentuates a heightened grasp of and adeptness in navigating the interplay of social and spatial circumstances, all while considering the well-being of communities, equity, and safeguarding the environment (Bilge, 2007).

Table 1. Social Sustainability Definitions From Literature (Source: Authors)

AUTHOR	SOCIAL SUSTAINABILITY DEFINITIONS IN LITERATURE
MCKENZI	A life enhancing standards in society, and an affair within communities which can attain the condition.
MEHAN&SOFLAEI	The pride of simple human needs and succeeding maintenance for future generations.
LITTING&GRIESSLER	A systematic concept, but its aspects are separated, leading to confusion in the sequence process.
AJMAL, KHAN, HUSSEIN & HELO	A quality of society especially for susceptible humans or groups.
BARRON&GAUNTLETT	In formal and informal ways, administrations, structures and connections busily support the magnitude of new generations to build healthy and quality living standards for the community.
PALICH&EDMONDS	A process aimed at designing sustainable and successful spaces to increase people's well-being by understanding what they need where they live.
ISO 21929-1:2011	The right of all mankind to benefit equally within the scope of health.
BERARDI	The keywords of social sustainability such as flexibility and adaptability.



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ANDERS	Human-centred quality of life, "human well-being", nature-centered "environmental well-being" and it refers to the situation of "having a good place" based on space.
BRAMLEY&POWER	It is associated with the provision of social equity (social equity), social inclusion (social inclusion) and social benefits (social capital).
DEMPSEY	It is explained as "social interaction", "participation in common groups-social networks in society", "social stability", "sense of pride/ commitment to the place", "safety and security".
MCKENZIE	Crafting thriving and habitable neighborhoods involves both structured and spontaneous methods, mechanisms, frameworks, and connections. The promotion of social sustainability transpires when the potential of forthcoming generations is duly accounted for and supported.
MAK VE PEACOCK	Social sustainability is to maintain and improve the well-being of present and future generations.
RAPOPORT	Spatial formations in different cultures are associated with cultural life.
HILLIER&HANSON	Space is not only the product of society, but society is also the product of space.
ASPINALL, CUKIER&DOBERSTEIN	The evaluations to be made about the quality of life form a sustainable society.
SANOFF	Spatial organizations, which are realized through the establishment and preservation of the balance between the human and the living environment, must contain values oriented to the wishes and needs of the user.
TRANCIK&MANEWA	It is the design and use of spaces to serve the desired purpose in social life.
SACHS	It is based on the values of equality and democracy and is the effective distribution of all human rights (political, economic, social and cultural)
POLESE&STREN	Development in harmony with the development of society is an element that promotes an environment that helps the entire population to live together harmoniously with improvements in the quality of life of culturally and socially diverse groups.



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DAVIDSON&WILSON Sustaining and enhancing the welfare of present and upcoming generations involves a cultural framework where the favorable elements of diverse cultures are recognized and upheld.

COLONTOINO It encompasses all endeavors within the primary thematic domains that address the societal aspects of individuals and communities, spanning from enhancing capabilities and fostering expertise to addressing disparities in the environment and spatial context.

CHAN&LEE Urban advancements entail crafting a balanced habitat, mitigating societal disparities and fragmentation, and enhancing overall life quality.

OMANN&SPANGENBERG It is the right of every individual to actively participate in society.

CHIU Termed as the enhancement of individual welfare and the just allocation of resources, this endeavor entails mitigating social marginalization and harmful strife that hinge on specific societal interactions, customs, frameworks, and principles embodying the social thresholds and confines of progress, necessitating assessment within the framework of environmental durability.

EMMELHANZ&ADAMS It includes the concepts of "diversity, philanthropy, health and safety and human rights".

HUTCHINS&SUTHERLAND A socially sustainable society is correct, fair, inclusive and democratic. A socially sustainable society ensures a good quality of life for current and future generations.

GOMAA&SAKR It is the improvement of society and social development that meets its needs.

JUAN People should be able to feel comfortable, healthy and safe in their homes and in the built environment. This situation has been defined as "ensuring optimal conditions".

YUNG, CHAN, & XU The concept is the desired goal because social sustainability is a process and the continuity of this process is in question in order to ensure it.

MOLDAN Social sustainability mandates safeguarding the cohesion of society and the capacity to collaborate towards shared objectives. It necessitates catering to personal requisites like physical health, mental well-being, nourishment, shelter, learning, and artistic manifestation.



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VALLANCE	The durability of social sustainability is intertwined with the persistence of social and cultural preferences, traits, and the environment as they are upheld across time.
ÇAHANTİMUR	Aiming for people to live a quality life for today and tomorrow; It is the satisfaction of basic human needs.
BERKELEY	It is about the quality of life of individuals now and in the future.
UNITED NATIONS	It can be achieved by eliminating poverty in the construction of sustainable societies and environments.
WACOSS	The characteristics that should be possessed by socially sustainable communities are reflected in five principles: equality, diversity, interconnectedness, quality of life, democracy and governance.
PARTRIDGE	it is a quality of life, equality (social justice), inclusiveness, accessibility, future-orientation, and participatory process.
STIFTUNG	This notion encompasses Fundamental necessities, Societal safety nets, Equitable avenues for engagement within a democratic community, and fostering prospects for societal innovation.
THIN	It is social justice, solidarity, participation, security.
EGAN	It is stated that in the measurement of social sustainability, the preference is to use both qualitative and quantitative methods in addition to statistical methods. In the evaluation processes, it is emphasized that qualities such as accurate assessment, sound decision-making, communication skills, leadership, etc., come to the forefront.
BIART	The concept of social sustainability aims to anticipate and develop solutions for potential challenges that may arise while creating a harmonious and actively functioning society, with minimal changes to the social structure, in the long-term development strategies of communities.
ASSEFA&FROSTELL	It argues that while economic and environmental sustainability form the purpose of sustainable development, social sustainability is the expected ultimate point of sustainable development.
HOLDEN	It states that social sustainability is an urban development process that fosters harmonious social relationships,



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enhances social integration, and improves living conditions for the entire society.

VALLANCE, PERKINS & DIXON & It states that neglecting social sustainability data leads to the development of uncertain and inadequate theories.

3. CONCLUSION

The organization of social interactions among people and the nature of these interactions are shaped by the constructed surroundings. Simultaneously, the constructed environment assumes a crucial function in either facilitating or impeding the advancement of activities within societal life. Within this dual relationship, the interplay between societal existence and the constructed environment accentuates the significance of the built environment and its spatial attributes concerning social sustainability. At this juncture, the attempt to define social sustainability through various methods across different disciplines has led to a confusion in the literature due to the absence of these distinct definitions coexisting. In this study, the compilation of articles and authors with a high number of citations among all these definitions underscores its significance. Because human beings are at the center of architecture, it is possible to directly or indirectly relate many topics addressed in the architectural design process to social sustainability. In this regard, examining and comprehending the definitions derived from the literature regarding social sustainability will shed light on all future endeavors falling under the realm of architecture and social sustainability.

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**INVESTIGATION OF THERMAL HOTELS IN TERMS OF LANDSCAPE DESIGN:
THE CASE OF AFYONKARAHISAR**

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ABSTRACT

Health tourism, which has existed throughout history, plays a vital role in all sorts of tourism. These treatments and leisure trips have also contributed to the expansion of health tourism. 'Thermal tourism,' which is part of health tourism, arose as a result of people's search for alternative treatment methods for health problems, their desire to spend time away from daily life, and the need to seek peace by getting away from city problems and being alone with nature. This sort of tourism, which makes use of natural resources for health purposes, has resulted in the establishment of several facilities to protect or improve people's mental and physical health. Thermal hotels in Afyon province, which are rich in thermal water potential, are discussed in this paper. The study's goal is to evaluate and quantify the design impact of landscape regions on thermal accommodation facilities. The four largest hotels in terms of area were considered within the scope of the study. The hotels were rated using six primary criteria based on information acquired from on-site observations and interviews. The entrance section, parking area, recreation areas, urban equipment, planting and structural design are examples of these. In the conclusion section, numerous ideas are made on how these unfavorable landscape locations might be used more efficiently and how the design can be improved while keeping the connection between health and landscape in mind.

Keywords: Thermal Tourism, Thermal Hotels, Afyonkarahisar, Landscape Design.

1. INTRODUCTION

Tourism's etymological root is the Latin word "tornus" which means "to depart from some location or point and return to the same location or point again" (Oruç, 2004; Şemşimoğlu Erhan, 2010). Tourism is defined as "all of the economic, cultural and technical measures and studies carried out to attract tourists to a country or region, a trip made for these purposes such as rest, entertainment, seeing and getting to know" in the Turkish Language Association dictionary (Turkish Language Institute, 1998).

The tourism industry continues to emerge as a popular industry around the world. The rise in human living standards and social rights, as well as the monotony and stress of daily life, alter people's expectations of tourism activities, as well as their preferences and desires for tourism. As a result, people are increasingly resorting to other kinds of tourism in addition to sea-sand-



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sun tourism. Health is clearly an important component that draws people to tourism (Erdoğan & Akınoğlu, 2008).

Traveling to places other than one's current location to safeguard or improve one's mental and physical health is often referred to as health tourism. T.C. The Ministry of Culture and Tourism (KTB) defines health tourism as "a type of tourism that allows the growth of health institutions by using international patient potential with those in need of physical therapy and rehabilitation" (Buldukoğlu, 2014).

The Turkey Health Tourism Board (SATÜRK) assessed health tourism under four broad categories. Thermal health tourism, medical tourism, elderly tourism (3rd age tourism) and disability tourism are examples of these (Zararsız, 2022).

Thermal tourism, which is part of health tourism, is a type of tourism that tries to improve deteriorating health or further improve health by visiting facilities developed in places where thermal water flows and using various thermal applications and supportive therapies. Some physical disorders are cured and people are made to feel more psychologically relaxed in mineral spring, thermal, hot spring, and similar facilities (Buldukoğlu, 2014).

Turkey lies on a significant geothermal belt in this direction. Combining thermal tourism with other types of tourism and making it available to visitors raises demand and interest in this sort of tourism. This study focused on Afyonkarahisar province, which has significant thermal resources in our country. The study is aimed at examining thermal tourism facilities, which play a key role in tourism and to quantify their contribution to accommodation facilities by analyzing landscape areas in terms of design.

1.1. Thermal tourism and Turkey

Thermal tourism, as defined by the Ministry of Culture and Tourism, is "a type of tourism that occurs with the use of thermal waters for entertainment and recreation purposes, as well as cure (treatment) applications made by combining various types of methods such as thermo mineral water bathing, drinking, inhalation, mud bathing, as well as support treatments such as climate cure, physical therapy, rehabilitation, exercise, psychotherapy, diet" (Bucak & Özkaya, 2013). Thermal tourism applications are classified based on the needs of the visitors. Physiotherapy, thalassotherapy, balneotherapy, inhalation applications, climatotherapy, cure, spa treatment, uvalism and hydrotherapy are some examples (Coşkun, 2022).

People all over the world, including our own country, are becoming increasingly interested in thermal tourism in order to alleviate the health problems caused by city living, as well as to rest and refresh themselves (Mercan, 2006). Thermal tourism is now popular all over the world, particularly in Southern, Central and Eastern Europe, Asia (The Middle East, Japan, China, and the Turkic Republics), South America (Argentina, Mexico and Colombia) and North Africa (Morocco and Tunisia) (Bucak & Özkaya, 2013). Our country ranks first in Europe in terms of resource potential and third in terms of spa applications and it is one of the top seven countries in the world in terms of geothermal resource richness and potential (Şemşimoğlu Erhan, 2010). In Turkey, there are about 520 operating spa facilities associated with the Ministry of Health that utilize geothermal resources (MAPEG, 2022) (Figure 1).



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Figure 1. Thermal tourism facilities in Turkey, including cities with hot springs and an estimate of the number of facilities (“Türkiye Kaplıcaları Portalı”, n.d.)

According to KTB 2022 figures, the total number of visitors to accommodation facilities with tourism operation certificates in our nation is 2.420.791. Figure 2 shows that 25,60% are foreigners and 74,40% are locals. Based on the data, it can be concluded that the facilities are primarily preferred by domestic tourists. After reviewing the nation and facility type titles, it was discovered that thermal facilities garnered the most attention from Europe.

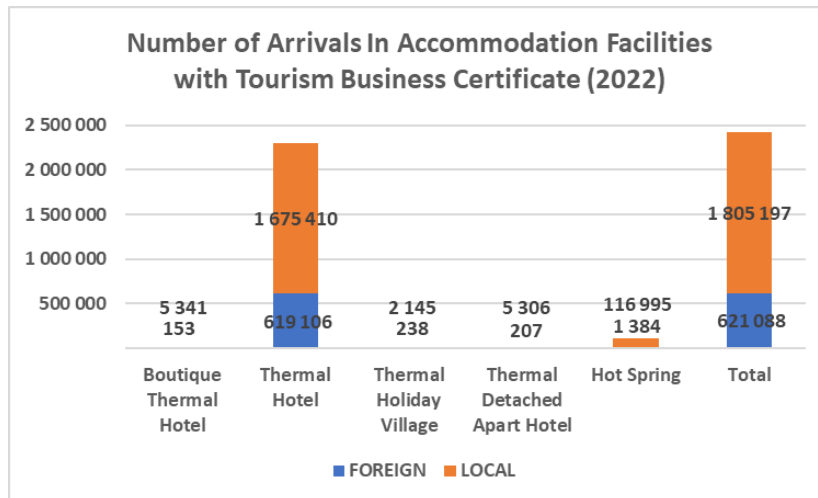


Figure 2. Arrival numbers in 2022 by facility types in Turkey (KTB, 2022)

When thermal tourism statistics for 2022 were analyzed, it was discovered that the average stay in a thermal hotel was 2,04 days for foreigners and 2,06 days for locals; in thermal resorts, it was 2,6 days for foreigners and 2,23 days for locals. When the total is taken into account, thermal springs come in first with 2,38 days (Figure 3).

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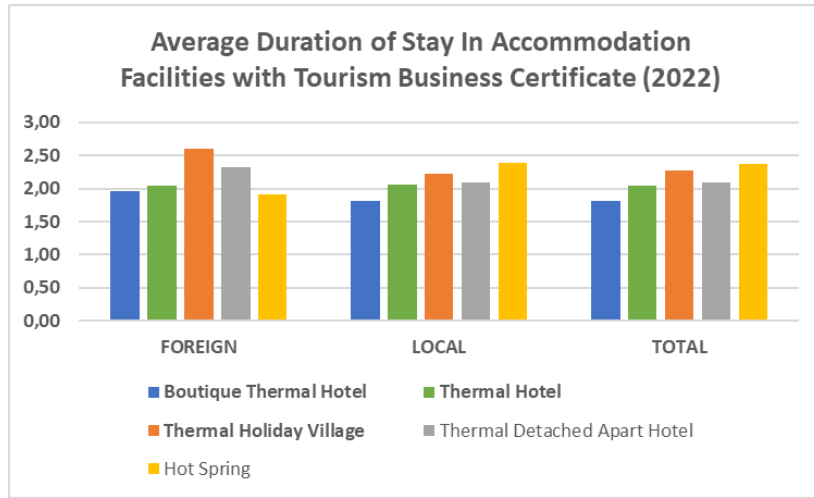


Figure 3. The average length of stay in 2022 according to facility types in Turkey (KTB, 2022)

2. MATERIAL and METHOD

Afyonkarahisar is located in the Aegean Region's Inner Western Anatolia section, west of the Anatolian Peninsula, connecting the east to the west and the north to the south, and is bordered by the provinces of Konya in the east, Burdur in the south, Isparta in the southeast, Uşak in the west, Eskişehir in the north and Kütahya in the northwest (Figure 4) (Aydingöz, 2005).

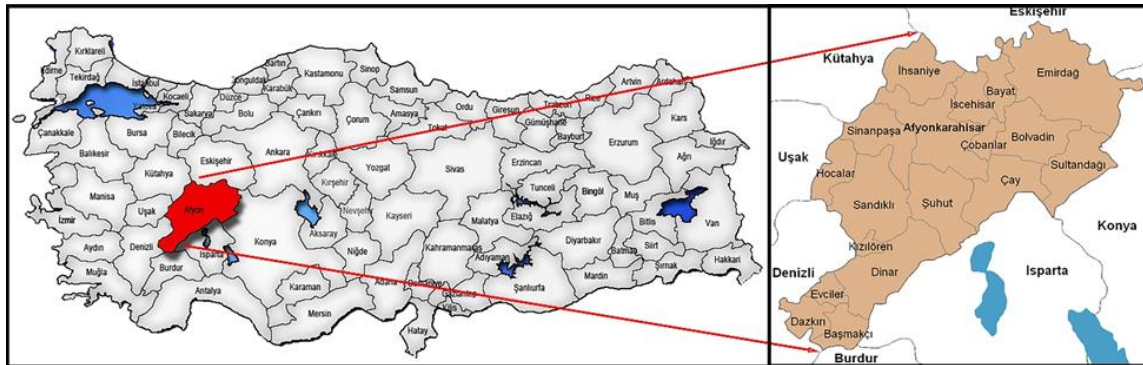


Figure 4. Location of Afyonkarahisar province

Afyonkarahisar province is part of the Phrygia Thermal Tourism Region, one of four regions covering 17 provinces that were designated as Thermal Tourism Centers by the KTB in 2007. Afyonkarahisar is home to four of the 34 thermal tourism centers established by the same decision (Sandıkçı et al., 2013). In terms of thermal tourism, some districts around the province stand out. The Central District, İhsaniye, Sandıklı and Bolvadin districts are among them. Given the locations of the areas under question, it is clear that the benefits of road transportation are significant (Taş, 2012).

Within the scope of the study, thermal facilities in Afyonkarahisar province were studied and four thermal facilities were chosen based on their magnitude in terms of landscape areas. These are: Akrones Thermal SPA Hotel, Grand Özgül Thermal Holiday Village, Korel Thermal Resort Clinic & SPA and NG Afyon Thermal Hotel. The location and area sizes of the facilities considered are shown in Table 1 below.



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Table 1. Locations and area sizes of selected facilities

No	Hotel Names	Location	Area Size (m ²)
1	Akrones Thermal SPA Hotel	Merkez	64.470
2	Grand Özgül Thermal Holiday	İhsaniye	112.080
3	Korel Thermal Resort Clinic & SPA	Merkez	87.660
4	NG Afyon Thermal Hotel	Merkez	45.730

Obtaining research data; It was completed as a result of collecting important information through a literature study, on-site observation, photographing and conducting necessary interviews. The chosen facilities were assessed under six major areas. These are; the entrance section, the parking area, the recreation areas, the urban equipment and the planting and structural design. The landscape designs of the facilities evaluated under these topics were given in the study, their appropriateness was examined and numerous suggestions on how they could be improved were made.

3. RESULTS and DISCUSSION

3.1. Akrones Thermal SPA Hotel

The Akrones Thermal SPA Hotel is located 10 kilometers from the town of Afyonkarahisar, 45 kilometers from Zafer Airport and 90 kilometers from Uşak Airport. There are 317 rooms and 750 beds in the hotel. The hotel's garden area is 20.800 m². The SPA area at the hotel is 16.000 m². There are also three outdoor and six indoor swimming pools in the hotel ("Basın", n.d.) (Figure 5).



Figure 5. General and plan views of the Akrones Thermal SPA Hotel ("Akrones Hotel", n.d.; "Google", n.d.a)

The Entrance Section: The hotel has only one entrance for vehicles and pedestrians. There is a security booth at the entrance (Figure 6). When examined in terms of landscape design, it was observed that it did not have an impressive and adequate landscape design.



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Figure 6. The entrance section of the Akrones Thermal SPA Hotel

Parking Area: The hotel meets the need for open and closed parking areas, but an examination of the open parking area reveals that the planting design is insufficient (Figure 7).



Figure 7. Parking area at Akrones Thermal SPA Hotel

Recreation Areas: The facility area includes an aquapark, children's swimming area, swimming pool, thermal pool, chess area, and children's playground (Figure 8). A walking track is located at the back of the facility, in addition to the seating places.

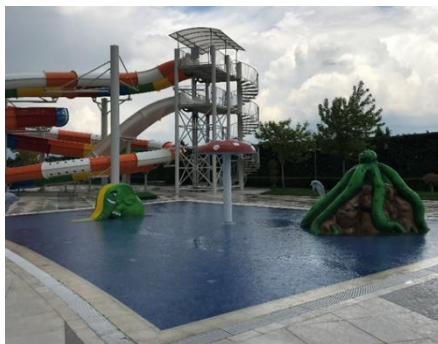


Figure 8. Children's pool and playground at Akrones Thermal SPA Hotel

Urban Equipment: Two types of lighting are used in the hotel: low and high. There are open-top seating areas for incoming guests. A single type of garbage bin was used in the area. Rattan material was preferred in outdoor seating elements and is suitable for climatic conditions (Figure 9).



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Figure 9. Akrones Thermal SPA Hotel urban equipment

Planting Design: Plant species that could adapt to the region's climatic circumstances were preferred among those used. *Juniperus sabina* (savin) is the most popular species in the area (Figure 10).



Figure 10. Akrones Thermal SPA Hotel planting design

Structural Design: There is an ornamental pool in the front and backyard. In the backyard, seating areas were built with terracing techniques. Informal design is dominant in the area. Different pavement types were used in the area (Figure 11). Rubber flooring is preferred in the children's playground. There are no accessible design solutions in the area.



Figure 11. Akrones Thermal SPA Hotel structural design

3.2. Grand Özgül Thermal Holiday Village

Grand Özgül Thermal Holiday Village is 20 km from Afyonkarahisar city center, 40 km from Zafer Airport and 15 km from İhsaniye centre. It has 606 rooms, including 489 suites, 92 deluxe suites, 25 luxury villas and 1 VIP villa and a capacity of 2.500 beds. The hotel has a social



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facility area of 20.000 m² (Figure 12). There is a SPA with a total usage area of 15.560 m², 2 outdoor and 2 indoor swimming pools, 2 indoor entertainment pools and an aquapark. The hotel also has 2 cave pools (Damlataş Cave) and two thermal pools ("Hakkımızda", n.d.).



Figure 12. General and plan views of the Grand Özgül Thermal Holiday Village ("Grand Özgül Termal Tatil Köyü", n.d.; "Google", n.d.b)

The Entrance Section: There is only one entry to the hotel for both automobiles and pedestrians. At the entrance, there is a security booth (Figure 13). An aesthetic appearance could not be achieved in terms of landscape design in the entrance section.



Figure 13. The entrance section of the Grand Özgül Thermal Holiday Village

Parking Area: At the hotel, only outdoor parking is provided. Each block has its own parking lot. Parking lots are insufficient when it comes to planting design (Figure 14).



Figure 14. Parking lot at Grand Özgül Thermal Holiday Village

Recreation Areas: A children's playground, a small zoo, a multi-purpose field (basketball-volleyball-tennis), a football field, a trampoline, a sports field, and an entertainment area are all available at the hotel. The football field ground is in reasonable condition, but the multi-purpose



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field ground is in bad condition. The materials utilized in children's playgrounds are outdated and unsuitable (Figure 15).



Figure 15. Recreational areas at Grand Özgül Thermal Holiday Village

Urban Equipment: In the area, three forms of illumination were used: lighting installed on trees, low lighting, and high lighting. The open and covered seating areas have been designed in a natural style. Swings can be found in some areas of the area. For garbage cans, a single type has been chosen (Figure 16).



Figure 16. Grand Özgül Thermal Holiday Village urban equipment

Planting Design: Planting design is not given much consideration in the area. On the roadway, tall trees are followed by shrubs and ground coverings (Figure 17).



Figure 17. Grand Özgül Thermal Holiday Village planting design

Structural Design: The landscape in the area is sloped and hilly. The facility has one ornamental pool in the centre area and two ornamental pools in the back. The location has observation



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terraces as well as bridges. In ornamental ponds, artificial rock is used. Different pavement types were used in the area (Figure 18).



Figure 18. Grand Özgül Thermal Holiday Village structural design

3.3. Korel Thermal Resort Clinic & SPA

Korel Thermal Resort Clinic & SPA is located 13 kilometers from the town of Afyonkarahisar and 45 kilometers from Zafer Airport. The facility's landscape area is 31.140 m². There are 329 rooms and 1.000 beds at the facility. There are also two outdoor and four indoor swimming pools, four thermal pools for spa treatments and a 4.000 m² health complex with an SPA and a clinic ("Kurumsal", n.d.) (Figure 19).



Figure 19. General and plan views of the Korel Thermal Resort Clinic & SPA ("Korel Thermal Resort Clinic & SPA", n.d.; "Google", n.d.c)

The Entrance Section: The hotel has a single vehicle and pedestrian entrance. At the entrance, there is a security booth. In terms of landscape design, the entrance part is insufficient (Figure 20).



Figure 20. The entrance section of the Korel Thermal Resort Clinic & SPA

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Parking Area: It offers an open parking lot for 200 vehicles, a helipad, and an electric vehicle charging station. There is no indoor parking (Figure 21). Even though the helipad is outdated, it is critical to include both the runway and the charging station for electric vehicles in order to keep up with advances and incorporate them into the design.



Figure 21. Korel Thermal Resort Clinic & SPA parking area and helipad

Recreation Areas: A children's playground and two swimming pools are available at the venue. There is bicycle access to the facility, and free bicycle use is planned for returning clients (Figure 22).

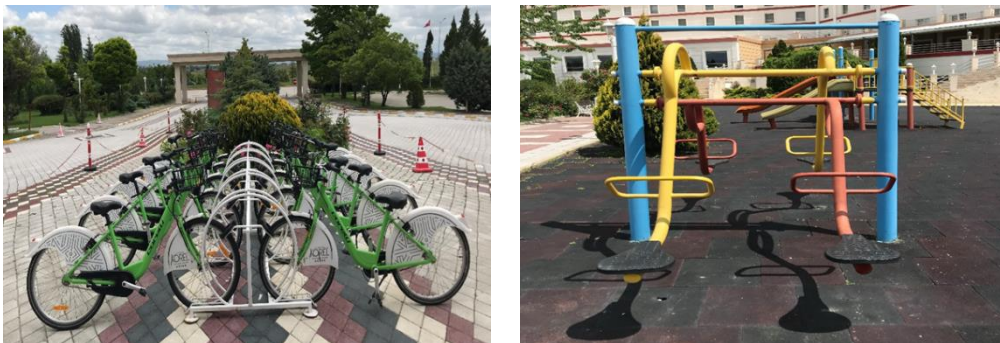


Figure 22. Korel Thermal Resort Clinic & SPA bicycle area and children's playground

Urban Equipment: There were two types of illumination used: low and high. The facility made use of a variety of garbage cans. The space includes three pergolas and different sitting features (Figure 23).



Figure 23. Korel Thermal Resort Clinic & SPA urban equipment



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Planting Design: In terms of planting landscape design, the area is insufficient. Trees are arranged irregularly. Dolomite stone has been used to create a variety of designs (Figure 24).



Figure 24. Korel Thermal Resort Clinic & SPA planting design

Structural Design: There is an ornamental pool in the front garden of the hotel. Different pavement types were used in the area. The same path is used for hiking and cycling. The backyard of the hotel is accessed by stairs. However, there is no ramp solution. There are no accessible design solutions in the area (Figure 25).



Figure 25. Korel Thermal Resort Clinic & SPA structural design

3.4. NG Afyon Thermal Hotel

At the intersection of all routes, NG Afyon is 45 kilometers from Zafer Airport and 90 kilometers from Uşak Airport. The facility's landscape area is 11.480 m². The complex has a total of 16 pools. 13 of these pools are indoor (seven have thermal water features) and three are outdoor (one has a thermal water feature) ("Aliva SPA", n.d.) (Figure 26).



Figure 26. General and plan views of the NG Afyon Thermal Hotel ("NG Afyon Wellness & Convention Afyon Türkiye", n.d.; "Google", n.d.d)



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The Entrance Section: The hotel has a single vehicle and pedestrian entrance. At the entrance, there is a security booth. In terms of landscape design, the entrance part is insufficient (Figure 27).



Figure 27. NG Afyon Thermal Hotel entrance section

Parking Area: It contains a total of 1,800 open parking spaces. The parking lot and swimming pool area were separated by vegetative screening (Figure 28).



Figure 28. NG Afyon Thermal Hotel parking area

Recreation Areas: The facility has three fields: a fire pit for nine people, a coloring house for children, a multi-purpose field (basketball-volleyball) and two tennis courts (Figure 29).



Figure 29. Recreational areas at NG Afyon Thermal Hotel

Urban Equipment: A standardized waste can was utilized. Bird nests were built in the trees for the local birds. The walking trails are accompanied by sculptures, although their designs and the purpose of the artistic objects are unknown (Figure 30).



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Figure 30. NG Afyon Thermal Hotel urban equipment

Planting Design: The ornamental pools in the area were decommissioned and used in the plant composition, which did not seem appealing in terms of design. In general, vegetal screening was preferred to separate the spaces. The entry area was made more inviting by the use of *Drosanthemum floribundum* (persian carpet) (Figure 31).



Figure 31. NG Afyon Thermal Hotel planting design

Structural Design: There is an ornamental pool only in the central part of the hotel. Different pavement types were used in the area (Figure 32). There are no designated walking paths for individuals who wish to walk. The hotel's entryway is slanted, although the rest of the property is flat. For the disabled, there is a ramp at the hotel's entrance.



Figure 32. NG Afyon Thermal Hotel structural design

4. Conclusions and Recommendations

In this study, four facilities in the Afyon town were analyzed and rated based on six primary criteria: Akrones Thermal SPA Hotel, Grand Özgül Thermal Holiday Village, Korel Thermal



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Resort Clinic & SPA and NG Afyon Thermal Hotel. Table 2 shows the data received as a consequence of the examination on a facility level.

Table 2. Criteria-based evaluation of selected facilities

Criteria	Subcriteria	Akrones Thermal SPA Hotel	Grand Özgül Thermal Holiday Village	Korel Thermal Resort Clinic & SPA	NG Afyon Thermal Hotel
Entrance Section	Controlled entry	✓	✓	✓	✓
Parking Area	Outdoor parking	✓	✓	✓	✓
	Indoor parking	✓	✗	✗	✗
Recreation Areas	Outdoor pool	✓	✓	✓	✓
	Indoor pool	✓	✓	✓	✓
	Outdoor children's pool	✓	✗	✓	✗
	Children's play area	✓	✓	✓	✗
	Sports field	✗	✓	✗	✓
	Walking track	✓	✗	✗	✗
	Bicycle usege	✗	✗	✓	✗
	Different activities	✓	✓	✗	✓
Urban Equipment	Seating groups	✓	✓	✓	✓
	Lighting	✓	✓	✓	✓
	Trash cans	✓	✓	✓	✓
	Artistic objects	✗	✗	✗	✓
	Information signs	✓	✓	✓	✓
	Water elements	✗	✓	✗	✓
Planting Design	Domain-Specific use	+	+	+	+
	Species richness	+	-	+	+
	Design	+-	-	-	+-
Structural Design	Domain-Specific use	+	+	+	+
	Pavement richness	+	+-	+	+
	Diversity	+	+-	+	+
	Design	+-	-	+-	+-
	Barrier-Free design	-	-	-	+

*✓(available) ✗(unavailable); -(bad), +(good), +-(average)

The following are the outcomes of the evaluations conducted at the specified thermal facilities:



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- The entrances to all facilities are controlled. However, there are no attractive landscaping arrangements that will emphasize the entry and appeal to the eye, particularly at facility and building entrances.
- When examining the parking areas of the facilities, it is clear that the majority of them do not offer indoor parking. It has been discovered that at facilities with open parking lots, plant species that shade the vehicles are not utilized and plant design is inadequate.
- When the facilities' recreational facilities were reviewed, it was discovered that sports fields were not available in every facility and those that were available were limited to a few fields. There are also no walking trails in the facility, which would allow for integration with nature. Aside from these functions, there were no designs of distinct recreation spaces that would provide a human-nature approach in the facilities.
- Although the urban equipment of the facilities is found to be adequate, the most significant problem identified is that it is outdated and neglected. It has been determined in some facilities that there is no compatibility between the equipment and that acceptable materials are not utilized. Water elements were not used in every facility, although they were included in the plant design in some. The various water design components were not widely implemented in the facilities. There are very few artistic objects used and those that are available are incompatible with the concept.
- When the plant designs of the facilities are examined, it is discovered that, while plants native to the area are used, the size, form, color and texture characteristics of the plants are ignored and aesthetically appropriate plant species are not used in the designs. Another essential aspect to note is that the plant design in the facilities is not taken into account as a whole, but is just glossed over with different layouts at different places.
- When the structural designs of the facilities were evaluated, it was discovered that the floor paving had a lot of variety, but their harmony and combinations were not adequate. Some paving was found to be deteriorated. A comprehensive approach to structural design has not been seen as much as in vegetative design. Most facilities have not considered the concept of barrier-free design.

Landscape designs in thermal tourism facilities must be enhanced to address the inadequacies identified in these findings. Furthermore, thermal tourism is practiced not only to maintain and promote physical health, but also to protect and improve mental health. At this stage, the visitors' goal is to enjoy a nice and quality time while also making time for themselves by easing the fatigue of working life. When examined from this angle, the landscape design of thermal tourism facilities was found to be more structure-oriented. When the designs are inspected, it is clear that the region was not taken into account as a whole and that the landscape design was added later and was solely utilized to cover the gaps left by the structural design.

Thermal tourism started as an alternative to coastal and marine tourism, which are referred to as the "3S" in world tourism ("Sun", "Sand" and "Sea"). When the landscape designs of the two types of tourism are compared, it is clear that the design approach in thermal tourism facilities is weaker and more irresponsible.

However, landscape design is critical in these contexts where mental and physical health are prioritized. Landscape areas have a major impact on overall mental health, stress and depression



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reduction and cognitive function improvement. As a result, landscape designs that connect human beings to nature, encourage exercise and socialization must be incorporated into these institutions.

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BIBLIOMETRIC ANALYSIS OF STUDIES ON URBAN LANDSCAPE CONCEPT

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ABSTRACT

Urban landscape is a discipline that deals with the planning, organization, and design of outdoor spaces in urban areas. Urban landscaping aims to improve the quality of life of urban dwellers by ensuring environmental sustainability. Urban landscape applications can play an effective role in ensuring the interaction of people with nature in cities, the sustainability of ecosystem services, and the protection of natural resources in cities. This study aims to conduct a bibliometric analysis of scientific studies on the urban landscape, which is of great importance in terms of the physical and psychological health of urban people and environmental sustainability in today's rapidly increasing urbanization. Bibliometric analysis enables to reveal the production of knowledge by examining various characteristics of scientific research in a particular field. This research, it was tried to determine the distribution of scientific studies on the concept of the urban landscape by years, authors, types of publications, in which countries the studies on the concept were mostly conducted, frequently used keywords, areas related to the concept, and other prominent details through bibliometric analysis. The Scopus database was determined as the study population. In the database, 1359 scientific documents were utilized. As a result of the study, it was determined that the studies on urban landscape started in 1968 and that there has been an increasing trend since 2016, 145 scientific studies were conducted in 2022, the most studies were produced at Arizona State University in the United States of America, and the keywords urban planning, urban area, land use were frequently used in the studies.

Keywords: Urban Landscape, Bibliometric Analysis, Landscape Architecture.

1. INTRODUCTION

It is known that cities, where most of the world's population lives, are growing and developing rapidly. changes and transformations are observed in urban areas due to growth and development. As a result of the aforementioned change and transformation process, the urban landscape is extremely important in terms of increasing the quality of life in urban areas and ensuring sustainability. Urban landscape is a multidimensional discipline that deals with the organization and design of the urban environment and includes many factors such as environmental sustainability, social welfare, aesthetic values, and protection of natural resources. The concept of urban landscape refers to the composition of the landscape in the city, a conscious order of the urban area. In the concept of urban landscape, the relationship of the existing structures in the urban area with each other and with unstructured areas should be considered as a whole (Karaman, 1995). Along with the physical structure, the socio-cultural



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structure also has an important effect on the formation of the urban landscape (Çelik and Yazgan, 2007). In this context, bibliometric analysis of the research on the concept of urban landscape will help us to understand the development of the subject in question and to determine the directions of future studies. With this analysis, it will be possible to reveal how the urban landscape has developed, the distribution of scientific studies by years, in which countries the studies are mostly conducted, frequently used keywords, which disciplines contribute to the subject, and what other prominent details are.

This study aims to evaluate important topics, authors, publications, and citations in the field of Urban Landscape to reveal the essence, emphasis, evolution, and direction of scientific research in this field.

It is thought that this study will contribute to our understanding of the importance of the concept of urban landscape today and the future directions of scientific studies in this field, and it can be an important resource for researchers, planners, and decision-makers who want to focus on research in this field in the future.

Urban Landscape

In parallel with the rapid increase in the world population, it is known that population and physical growth in urban areas are increasing at the same rate. As a result of this increase, it is becoming increasingly difficult to create sustainable living spaces for cities. In the face of these problems, it becomes imperative to develop new perspectives and different approaches in planning and design for sustainable cities. One of these approaches is the urban landscape approach, which is known to provide many benefits to the city through urban ecosystems (Tezgör, 2021).

The urban landscape is "a heterogeneous combination of structures and other areas in the city and consists of pieces of land that can be distinguished by different usage and management models. The urban landscape reflects the urban fabric: green spaces at the building level, such as balconies, green roofs, and vertical gardens; green spaces close to buildings, such as residential gardens, playgrounds, parks, gardens of institutional buildings, planted areas on streets and avenues, cemeteries, sports fields, and hobby gardens; and more open green spaces, such as agricultural lands and gardens, forests, wastelands, quarries and dunes (Braquinho et al., 2015).

Urban landscape determines the relationship between the structures and unbuilt areas in the city as a whole, the structures with different characteristics in form, size, color, and form, and their organization (Çelik & Yazgan, 2007).

Urban landscape is "a socio-ecological system consisting of ecosystems shaped by natural, cultural, and social processes together" (Andersson, 2006). In urban landscape design, living and non-living materials as well as the elements that make up the city identity are taken into consideration when designing livable spaces to help preserve the city identity and transmit the identity from the past to future generations (Çelik & Yazgan, 2007).

Urban landscape deals with the design, planning, and management of built and open spaces in cities, taking into account environmental, aesthetic, social, cultural, and economic sustainability, and includes design and organization processes to make urban areas more livable, more functional and more attractive by combining natural and man-made elements. Urban landscape plays an effective role in protecting the physical and mental health of people as well



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as environmental resources. In line with these definitions, urban landscape is a conceptually and practically complex, multidisciplinary field and the scope of scientific studies in this field is constantly expanding.

2. METHOD

This study aims to conduct a bibliometric analysis of scientific studies conducted within the scope of the concept of urban landscape. Bibliometric analysis is a method used to examine the development and trend in academic literature on a particular topic or concept. In bibliometric analysis, certain characteristics of scientific documents such as authors, journal, subject, and publication information are analyzed quantitatively (Al & Tonta, 2004; Yalçın, 2010; Ulu & Akdağ, 2015; Yılmaz, 2017). Bibliometric research is based on analyzing certain characteristics of the content of documents or publications and obtaining various findings on scientific communication (Al & Coştur, 2007).

In this study, the Scopus database was determined as the study population, and 1359 scientific documents between 1968 and 2022 were utilized. In this study, "R" software was used to perform bibliometric analysis. Through bibliometric analysis, it was tried to determine the distribution of scientific studies on the concept of urban landscape according to years, authors, types of publications, in which countries the studies on the concept were mostly conducted, frequently used keywords, areas related to the concept and other prominent details.

3. FINDINGS and DISCUSSION

Within the scope the study, it is aimed to examine the studies on urban landscape design holistically by bibliometric analysis method. The findings obtained as a result of the study are given under headings.

General Status of Urban Landscape Studies

General information about scientific publications on the concept of urban landscape is given in Table 1.

Table 1. General information on scientific research published in Scopus data source within the framework of urban landscape

Definition	Results
Basic Information About Scientific Articles Published In Urban Landscapes	
Time range of scientific articles published in the urban landscape	1968 - 2023
Resources within the scope of urban landscape (Journals, Books, etc.)	741
Documents published within the scope of the urban landscape	1359
The annual growth rate of publications on urban landscape	7,45
The average age of documents in the urban landscape	8,79



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Average citation per document for urban landscape	14,99
Document Contents	
Keywords	6829
Authors' Keywords	4011
Authors	
Number of authors publishing within the scope of urban landscape	3861
Number of single-authored papers on urban landscape	252
Collaboration With Authors	
Single-authored documents in the context of urban landscape	276
Co-authors for the document in the context of urban landscape (%)	3,3
International co-authors in urban landscape (%)	11,99
Document Types	
Article	906
Book chapter	83
Proceedings book	319
Review article	34
Book	9
Note	3
Correction	2
Editorial	2
Short survey	1

According to Table 1, it is seen that scientific studies on urban landscapes started to be included in the Scopus database in 1968. It is seen that these studies consist of 906 articles, 83 book chapters, 319 articles in proceedings, 34 review articles, 9 books, 3 notes, 2 corrections, 2 editorials, and 1 short survey.

Distribution of Scientific Studies on the Concept of Urban Landscape by Years

The distribution of scientific studies conducted within the scope of the urban landscape concept by years is given in Figure 1



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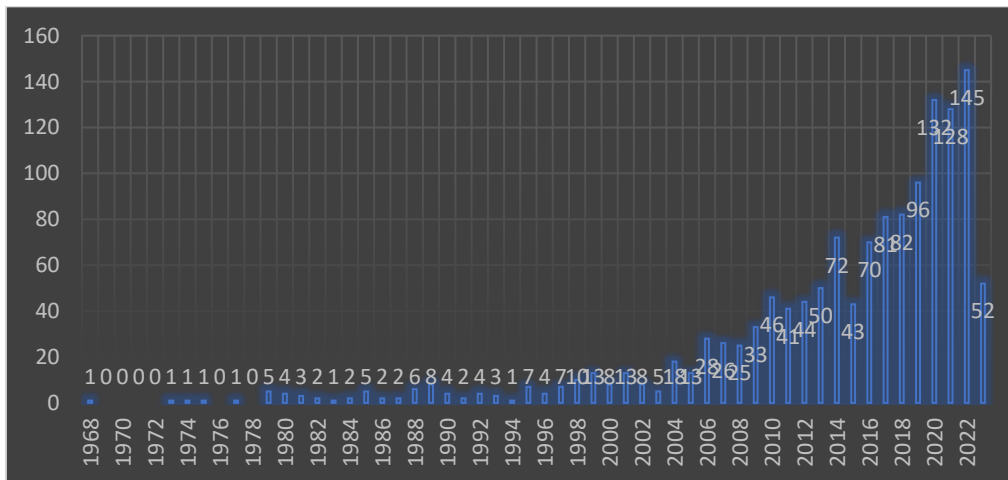


Figure 1. Distribution of scientific studies produced in the field of urban landscape by years

According to Figure 1, it is revealed that the studies on the subject were first produced in 1968, the number of studies was limited until 2004, increased since 2005, and has shown a continuous and rapid increase since 2016. In 2022, the decrease in the number of studies is thought to be due to the indexation period of the scientific studies published within the scope of the subject in the Scopus database.

Keywords Used in Scientific Studies Published in the Field of Urban Landscape

The keyword cloud created according to the frequency of use of keywords used in scientific studies in the field of urban landscape is given in Figure 2. The frequency amounts of the keywords used are given in Table 2, the distribution of keywords according to years is given in Figure 3, and the keyword network is given in Figure 4.



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Table 2. Frequency use of keywords

Word	Frequency
Urban Planning	183
Urban Area	177
Landuse	149
United States	129
Landscaping	124
Article	123
Sustainable development	110
Urbanization	80
China	77
Water Quality	74



Figure 2. Keyword Cloud

When Figure 2 and Table 2 are examined, it is seen that the most frequently used keywords in the studies in the field of urban landscape are "urban planning" (183), "urban area" (177), "land use" (149), united states (129), "landscaping" (124), "article" (123), "sustainable development" (110), urbanization (80), China (77), water quality (74).

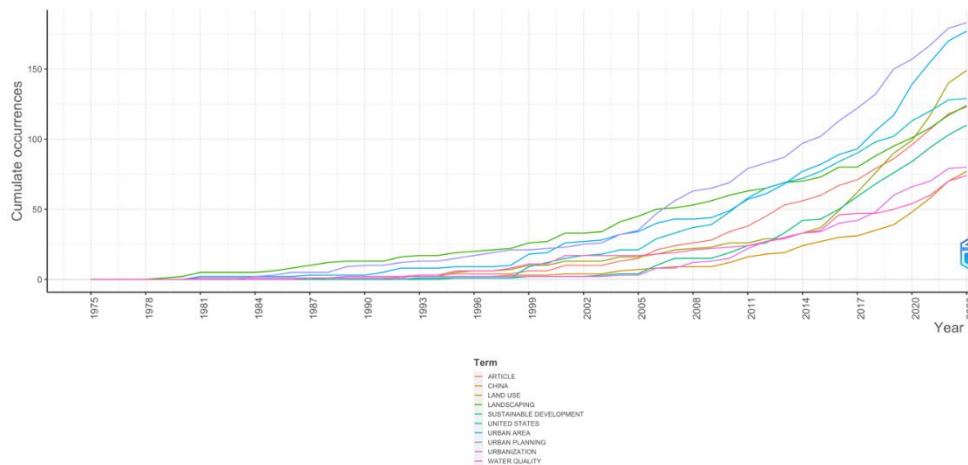


Figure 3. Distribution of keywords by years

When the graph of the distribution of keywords by years is examined, it is seen that the words "urban planning", "landscape", "urban area", "land use", and "sustainable development" are mostly used in scientific studies conducted in recent years.



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When Table 3 is examined, it is seen that the articles within the scope of the subject are frequently produced from Arizona State University and University of Florida institutions located in the United States of America. It is possible to see in Figure 5 that the number of scientific articles produced in these institutions has increased with increasing momentum since 2002.

Sources and Temporal Distribution of Scientific Documents Produced within the Scope of Urban Landscape according to Frequency of Publication

The top ten publication sources that frequently produce scientific articles related to the urban landscape area are given in Table 4 according to the frequency of scientific articles published and the graph of the production distribution of publication sources over time is given in Figure 6.

Table 4. Top ten publication sources that frequently produce scientific articles and the number of production

Source	Frequency
Acta Horticulturae	56
Iop Conference Series: Earth And Environmental Science	44
Landscape And Urban Planning	33
Urban Forestry And Urban Greening	32
Iop Conference Series: Materials Science And Engineering	27
Sustainability (Switzerland)	25
Urban Ecosystems	21
E3s Web Of Conferences	19
Environmental Management	13
Lecture Notes in Civil Engineering	11

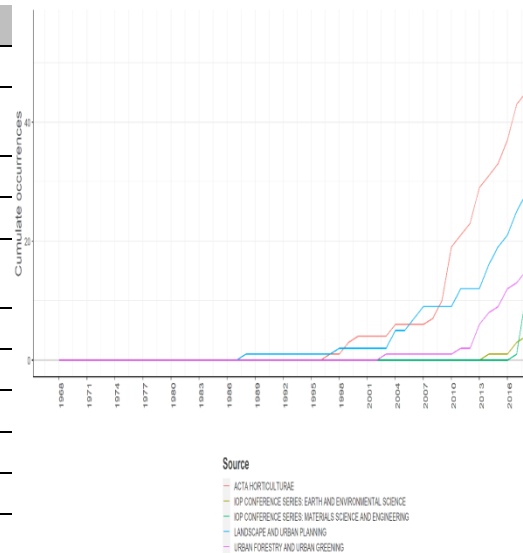


Figure 6. Production distribution of publication sources over time

It can be said that "Acta Horticulture", "Top Conference Series: Earth And Environmental Science", "Landscape and Urban Planning" and "Landscape and Urban Planning" are the most frequent publications and the frequency of production has been on increasing trend since 2003.

Researchers Producing Scientific Publications on the Scope of Urban Landscape, Number of Articles Published, and Most Cited Works

The number of publications of the researchers who produced the highest number of publications within the scope of the subject is given in Table 5, the frequency of production of the authors over time is given in Table 6, and the most cited publications on a global scale and the source of their publication are given in Table 7.



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Table 5. Authors and number of publications

Author	Number of Articles
Kelli L. LARSON	14
Na NA (Editör, Urban Space)	14
Jiachen LI	10
Liu XINGJIAN	9
Sharon J. HALL	8
Susannah B. LERMAN	8
Junyi ZHANG	8
Patricia GOBER	7
Ye LI	7
Zhichao LI	7

Table 6. Authors and frequency of publication production

Authors	Frequency	Year
Kelli L. LARSON	4	2020
Patricia GOBER	3	2010
Sharon J. HALL	3	2020
Jiachen LI	3	2018
Na NA (Editör, Urban Space)	3	2013
Patricia GOBER	2	2007
Ye LI	2	2010
Kelli L. LARSON	2	2019
Kelli L. LARSON	2	2021
Kelli L. LARSON	2	2022

When the table is examined, it is seen that most publications within the scope of the subject belong to Larso and Na Na, and the frequency of publication production belongs to Larso, which had 4 publications in 2020.

Table 7. Information on the most cited publications in the global dimension

Author	Publication Date	Publication Source	Access Number (DOI)	Number of Citation
Shiva L.	2001	Water Research	10.1016/S0043-1354(01)00062-8	564
Kaye JP.	2006	Trends in Ecology & Evolution	10.1016/j.tree.2005.12.006	528
Radeloff VC.	2018	The Proceedings of the National Academy of Sciences	10.1073/pnas.1718850115	441
Middel A.	2014	Landscape and Urban Planning	10.1016/j.landurbplan.2013.11.004	394
Lovell ST.	2010	Sustainability	10.3390/su2082499	390
Coley RL.	1997	Environment and Behavior	10.1177/001391659702900402	369
Persson J.	1999	Water Science & Technology	10.1016/S0273-1223(99)00448-5	335
Shashua - Bar L.	2011	International Journal of Climatology	10.1002/joc.2177	313
Chawla L.	2015	Journal of Planning Literature	10.1177/0885412215595441	297
Lin BB.	2015	Basic and Applied Ecology	10.1016/j.baae.2015.01.005	276



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It is seen in the Table that the highest number of citations (564) belongs to the publication titled "Buffer Zone versus Whole Catchment Approaches to Studying Land Use Impact on River Water Quality" published by Sliva L. in Water Research in 2001.

Temporal Distribution of Scientific Articles Published in the Scope of Urban Landscape by Countries

The temporal distribution graph of the scientific articles produced within the scope of urban landscape according to the top five countries is given in Figure 7'.

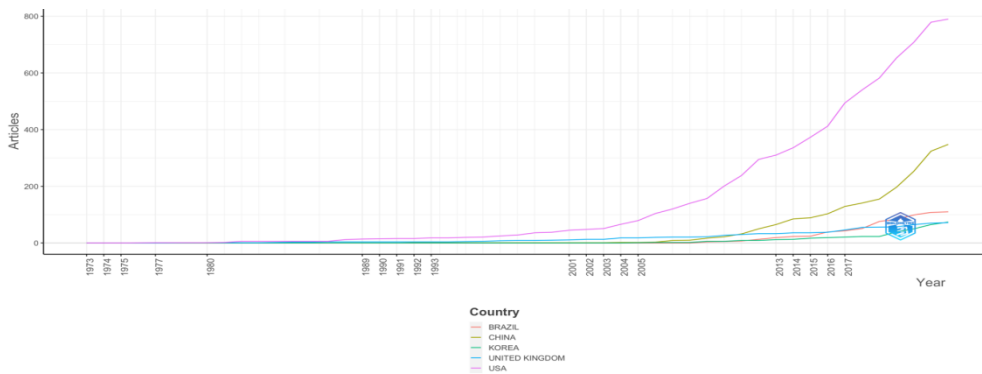


Figure 7. Temporal distribution of article production by country

The top five countries producing scientific publications on the subject are the United States, China, the United Kingdom, Korea, and Brazil. It is seen that the publications within the scope of the subject in the aforementioned countries have entered a rapid increase trend, especially since 2013, and this trend is high in the United States and China.

Keyword, Country, and Publication Source Relationship Status of Scientific Articles Published in the Scope of Urban Landscape

The 3-field diagram of keyword-country-publication source of scientific articles produced within the scope of the urban landscape is given in Figure 8.

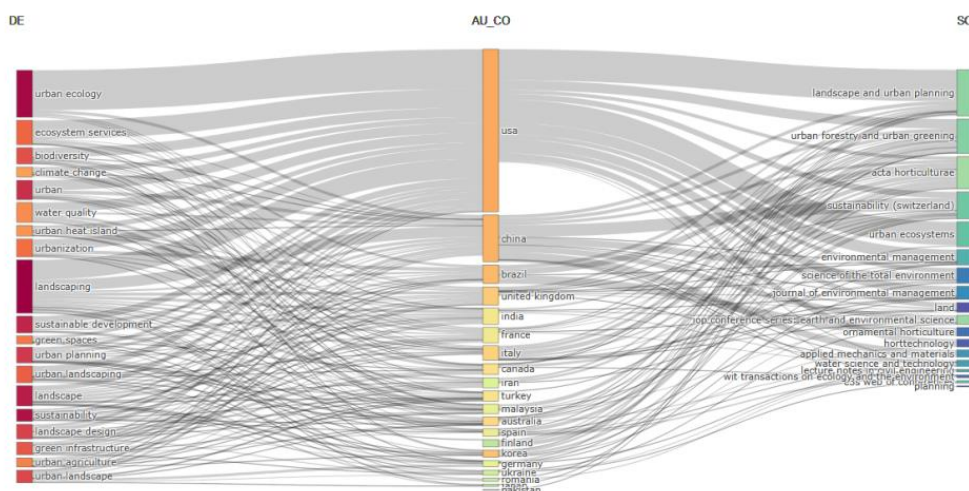


Figure 8. Temporal distribution of article production by country



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When the figure is examined, it is seen that the scientific publications produced within the scope of the subject are frequently published in Landscape and Urban Planning, the publications are frequently produced in the United States, China, and Brazil, and the words "landscaping", "urban ecology", "landscape", "sustainability", "urban" are mostly used as keywords.

4. CONCLUSIONS and RECOMMENDATIONS

This research was conducted to reveal the general situation, essence, emphasis, development and change process, and current importance of scientific studies in the field of the urban landscape and to provide a source for researchers who want to focus on studies in the field in the future, it is possible to say that there have been many studies on the subject until today and that the number and scope of these studies have expanded and developed in recent years. Today, the expansion and development of the scope of the concept in question in line with the increase in urban population and related urbanization and environmental problems in cities can be considered as usual.

When the sources in which urban landscape studies are published are evaluated, it is seen that the mentioned field of study is a multidisciplinary field that is covered by many professional disciplines, especially horticulture, environmental management, landscape and urban planning, urban forestry, material sciences, urban ecosystem, energy and earth sciences, civil engineering.

When the keywords used in the scientific studies published within the scope of the subject and their temporal distribution are examined, it is possible to see that the word "landscaping", which was frequently used in the first years of the studies, has been replaced by the word "urban planning" in recent years, and the words "urban area" and "land use" have been used more frequently in recent years. In this context, it is possible to say that the field of urban landscape has developed over time and is a research area that is frequently studied by sciences related to urbanization and land use.

The fact that Arizona State University, one of the world's leading universities, has produced the most publications on the subject may provide an idea that the subject is quite current and open to development and change.

When the publication with the highest number of references on the urban landscape (Buffer Zone versus Whole Catchment Approaches to Studying Land Use Impact on River Water Quality) is examined, it is seen that the effects of urban land use on water quality are evaluated in the research. In this context, it is possible to say that the urban landscape effect is very important to water quality and has been the subject of many scientific studies in this field.

When the studies of Kelli L. Larson, who has the highest frequency of publication and the highest number of publications within the scope of the subject, are examined, it is seen that the focus is on sustainability, ecosystem processes, social-ecological systems, cities, and water management. These fields of study reveal that the concept of urban landscape has multifaceted effects.

As a result of the bibliometric analysis of scientific studies conducted within the scope of the urban landscape, it has been revealed that urban landscape studies are a very important, effective, open-to-development, multidisciplinary field of study in line with the principle of sustainability in combating environmental problems in our world where urbanization is increasing rapidly. In this context, it is thought that it is of critical importance for researchers from different disciplines to work together in the stages of conducting scientific studies on the



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urban landscape, making decisions, and implementing them in the present and future within the scope of environmental health, human health, and sustainability.

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**IMPORTANCE AND SUSTAINABILITY OF CULTURAL HERITAGE ASSETS OF
DÖŞEMEALTI REGION (ANTALYA)**

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ABSTRACT

Döşemealtı District, one of the important districts of Antalya, is a residential area that has hosted different civilisations throughout history. Döşemealtı District, which has an important position as an accommodation centre thanks to the ancient Döşemealtı Road and Inns, is a settlement where different cultures come together and especially weaving is dominant, where Adalılar (Cyprus Immigrants), Muhajirs (Thessaly Immigrants) and different Yoruk tribes live together. It was named after the road consisting of ancient paving stones laid with 4 meters wide paving stones by the Romans of the Roman Period in the Derbent Strait, which is 2.5-3 km. northeast of Kovanlık Village of Döşemealtı District, where the plain ends and the first elevations of the Taurus Mountains begin and which was one of the roads connecting the cities of Pamphylia and Psidia in ancient times. Döşemealtı region has a very rich potential in terms of cultural heritage such as famous caves (Karain Cave, Kocain Cave, Kızılın Cave, Çarkini Cave), ancient cities, ancient Döşemealtı Strait, water cisterns, caravanserais, protected areas etc. As a result of the increase in migration from villages in the Döşemealtı region and the transformation of villages into neighbourhoods in the urbanisation process, the way of life has undergone rapid change and erosion. Thus, as a result of not giving due importance to cultural heritage values, their functions have started to lose their importance gradually. This study aims to reveal the natural and cultural heritage values and their importance in Döşemealtı Region. In this context, it is to develop suggestions for the protection, development and sustainability of the natural and cultural heritage values of the Döşemealtı region. Thus, it is envisaged to increase the conscious awareness of the relevant stakeholders (managers, decision-makers, institutions, NGOs, local people, tourism agencies, etc.).

Keywords: Döşemealtı Region, Cultural Heritage, Conservation, Sustainability. Antalya.

1. INTRODUCTION

Cultural heritage is a set of all kinds of tangible and intangible assets or values that are related to the past and experiences of a society, define its identity, and carry the characteristics of local and universal values that have survived to the present day with their vital continuity. It includes all the characteristics of the environment that emerged as a result of the interaction between people and places over time (Ünal, 2014; Pelit et al., 2018).

Tangible and intangible values that emerge as a result of the interaction and interaction between human-culture-space and environment are considered cultural heritage value that is vital in the



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transmission of culture, and the creation and protection of collective memory (Gül & Gül, 2021).

Cultural values or assets include many values such as architectural structures, monuments, beliefs, symbols and traditions specific to the country, region or settlement. These values are generally defined as tangible (archaeological, artistic, architectural structures) and intangible (beliefs, customs, traditions, traditions and customs, etc.) values (Bedate et al., 2004; Metin & Gül, 2017; Gül & Gül, 2021).

The General Conference of the United Nations Educational, Scientific and Cultural Organization meeting in Paris from 17 October to 21 November 1972, at its seventeenth session (UNESCO, 1992-2023). For this Convention, the following are recognised as "cultural heritage" (UNESCO, 1992-2023).

- **Monuments:** architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science;
- **Groups of Buildings:** groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science;
- **Sites:** works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view.

Cultural and natural heritage is increasingly threatened with extinction, not only due to traditional causes of deterioration but also due to changing social and economic conditions that aggravate the situation with even more egregious cases of damage or destruction (UNESCO, 1992-2023).

Today, the urbanisation process that develops horizontally and vertically, rapidly changing and evolving social, economic and technological processes, differentiating and changing lifestyles change and affect the unique structure of cultural heritage and ultimately lead to cultural erosion and destruction of cultural identity elements (Artun, 2001; Kanlı, 2015; Dikmen & Toruk, 2016).

When rural settlements in Anatolia are examined, rural spaces are shaped by their unique lifestyles and forms, natural and cultural landscape values have diversity and richness in terms of space and identity values that differ from region to region, even in villages located in the same region. Today, the increase in globalisation and urbanisation trends, inadequacy of opportunities in many areas such as social, economic, health, education, etc., and diversification of needs have put rural/local/village settlements under pressure, increased migration to cities, and often led to negative interaction with rural settlements. This situation has led to the change, degeneration or destruction of the local identity and landscape values of rural settlements. The natural and cultural values of rural settlements have turned into artificial spaces for consumption purposes in the context of modernisation and globalisation, just like urban spaces. (Gül et al., 2020a).



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Today, rural areas are losing their local identities and disappearing. For a sustainable cultural heritage, it is necessary to protect the natural and cultural environment without deterioration and to ensure that future generations benefit from all resources as they do today. For this purpose, it is of great importance to inform the relevant stakeholders and raise awareness for the identification and sustainability of cultural heritage values (Seçilmiş & Köz, 2015: 74).

The protection and preservation of local identity depends primarily on local people taking responsibility. Participation of local people should be ensured at every stage of the process in planning and management. To create a local identity, local holistic identity values should be evaluated, core values should be prioritised according to the perceptual level, and the area should be turned into a destination area through image and branding studies (Gül et al., 2019).

Today, tourism is the most important locomotive of economic and socio-cultural development. The planning of cultural tourism routes is of great importance for the protection of cultural heritage values and the utilisation of economic potential (Gül et al., 2020b).

Döşemealtı District, one of the important districts of Antalya, is a residential area that has hosted different civilisations throughout history. Döşemealtı District, which has an important position as an accommodation centre thanks to the ancient Döşemealtı Road and Hans, is a settlement where different cultures come together and especially weaving is dominant, where "Adalılar" (Cyprus Immigrants), "Muhacirler" (Thessaly Immigrants) and different Yörük tribes live together.

It was named after the road consisting of ancient paving stones laid with 4 meters wide paving stones by the Romans of the Roman Period in the Derbent Strait, which is 2.5-3 km. northeast of Kovanlık Village of Döşemealtı District, where the plain ends and the first elevations of the Taurus Mountains begin and which was one of the roads connecting the cities of Pamphylia and Psidia in ancient times (Döşemealtı Belediyesi, 2016).

Döşemealtı region has a very rich potential in terms of cultural heritage, especially famous caves (such as Karain Cave, Kocain Cave, Kızılın Cave, Çarkini Cave), ancient cities, ancient Döşeme Strait, water cisterns, caravanserais, protected areas, etc. (Döşemealtı Belediyesi, 2016).

In Döşemealtı region, the way of life has undergone rapid change and erosion as a result of increased migration from villages, rapid urbanisation process and transformation of villages into neighbourhoods. Thus, as a result of not giving due importance to cultural heritage values, their functions have started to lose their importance gradually.

This study aims to reveal the importance and value of the natural and cultural heritage values and historical processes of Döşemealtı Region. At the same time, it is to develop suggestions for the protection, development and sustainability of natural and cultural heritage values. In addition, it is envisaged to increase the conscious awareness of the relevant stakeholders (managers, decision-makers, institutions, NGOs, local people, tourism agencies, etc.) about the natural and cultural heritage values of Döşemealtı Region.

2. Material and Method

In the research, Döşemealtı Municipality website and other websites related to Döşemealtı were examined. Scientific research and publications on the Döşemealtı region were analysed. As a result of interviews, observations and examinations made with local people in the Döşemealtı



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region, heritage values were determined as a whole. For this purpose, it has been analysed under 3 main headings (Monuments, Building Groups, and Sites) accepted by Unesco as "cultural heritage".

3. FINDINGS

3.1. Existing Cultural Heritage Values of Döşemealtı Region

Döşemealtı District, which is 12 km. away from Antalya City Centre, is located in the north of Bucak, Konyaaltı in the south, Kepez in the east and Korkuteli in the west. There are 32 neighbourhoods in Döşemealtı District. Its surface area is 673,1 km². Döşemealtı was named after the 4-meter-wide road consisting of ancient paving stones in the Derbent Strait, which was one of the roads connecting the cities of Pamphylia and Psidia in ancient times. It is understood from the inscriptions on the milestones that the ancient Roman road called "Via Sebaste" (also called Alexander Road), which was not exactly determined by whom it was first used, was built by Augustus (Octavius), who was emperor for forty years, especially to fight Cilician pirates. The paved road, which continued to function during the Byzantine, Seljuk and Ottoman periods, was used as a migration route by Yörükler (Yoruks) until recently. For this reason, the local people called the gorge through which the road passes "Döşeme" "Döşeme Boğazı" and the plain under the road "Döşemealtı" (Döşemealtı Belediyesi, 2016).

In the Döşemealtı district, which has a very large area and where nomads with different names and at different times settled at close distances to each other, a mixed cultural structure was formed with the settlement of the Adalılar (Cypriots) and Thessalian immigrants, also known as Muhacirler among the people. According to Prof. Dr. Işın Yalçınkaya, Döşemealtı District, which is a settlement established in the plain near Karain Cave, is one of the oldest settlements in Türkiye.

3.1.1. Caves

In Döşemealtı; there are many caves (Karain Cave, Kocain Cave, Kızılin Cave, Çarkini, Boynuzluin, Öküzini Cave, etc.) which have been identified and are still under research in terms of cultural heritage with their natural life and historical dimension.

a. Karain Cave

Karain cave is located approximately 30 km northwest of Antalya city centre, northeast of the Yağca neighbourhood of Döşemealtı district (Figure 1). It is the most intensively researched Palaeolithic centre of Anatolia. Excavations started in 1946 and continued until 1973. Afterwards, the unexcavated areas were resumed in 1985 under the direction of Prof. Dr. Işın Yalçınkaya (Kartal, 1999).

It is considered to be the only cave in Anatolia where skeletal and dental remains of Neanderthal humans were found and which allowed the Middle Palaeolithic chronology to be established (Yalçınkaya & Özçelik; 2012). It was continuously inhabited by humans from the Lower Palaeolithic period until the Late Roman-Early Byzantine period (Yalçınkaya, 1988) and is the most important cult centre of Meter Orei, which means "Mountain Mother" or "Goddess Sitting in the Mountains" in the Pamphylia Region (Akın, 2016).

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a



b



c



d

Figure 1. a. View of Karain Cave, b. Skin scratching figure of Neanderthal Man found in Karain Cave section of Antalya Archaeological Museum, c. Meter Orei next to the entrance of the cave, d. Ataturk's Siliüeti made by Prof. Dr. İ. Kılınc Kökten on the cave wall (Original Photo: Öncü, 28/08/2021).

b. Kocain Cave

It is located in Hisaradağı / İndağı at an altitude of 1.171 m, about 45 km north of Antalya Province. Kocain Cave is 600 m long, 35 m wide at the entrance, 75 m wide inside and 50-60 m high in some places. In 1990, it was declared a 1st degree Archaeological-Natural Site. There is also a very large cistern dating from the Roman Period inside the Kocain Cave. There are also wall traces of a building complex dating back to the Roman Imperial Age in front of the cave. Inside the cave, near the entrance, on a rather large limestone rock mass suitable for inscription, the names of many "eirenarkhes" and "anteirenarkhes" and their assistants, the diogmites, are carved. A total of 28 inscriptions dedicated by eirenarkhes, anteirenarkhes and diogmites were discovered by the Italian researcher G. Moretti in 1919 and published in 1926. On the inscriptions published by Moretti, it was seen that many inscriptions were published incorrectly and incompletely, which were identified and corrected by Assoc. Prof. Dr Hüseyin Sami Öztürk in the new readings made in 2006 (Öztürk, 2015) (Figure 2 a-b-c).

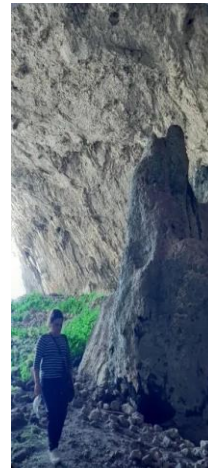
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a



b



c

Figure 2. a. View of the cistern from the entrance of Kocain Cave, b. Inscriptions on the rock from the ceiling to the floor, c. Cave interior (Original Photo: Öncü, 28/08/2021).

c. Kızılin Cave

Kızılin Cave is located within the borders of the Yağca neighbourhood of Döşemealtı District of Antalya Province. It is 1.6 kilometres from the centre of Yağca neighbourhood and 3.5 kilometres from Karain settlement. Kızılin is a Grade 1 Natural and Archaeological Site. However, it also falls within the Antalya Düzlerçamı Wildlife Development Area. Excavations were initiated by Professor İsmail Kılıç Kökten in the 1950s (Demirel et al., 2019) (Figure 3).



a.



b.

Figure 3, Kızılin Excavations, (Original Photo: Kartal, 1999)

d. Çarkini Cave



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It is a natural cave located northwest of Antalya city centre, 1 km northwest of Somaklı Street, Yağca neighbourhood and 2 km south-southwest of Karain Cave. A small excavation attempt was first made in 1957 by Prof. Dr. İ. Kılıç Kökten (Kartal, 1999).

d. Boynuzluin Cave

It is 30-31 km north-northwest of Antalya City centre; about 1 km northeast of Karain Cave and about 250 m northwest of Öküzini Cave. It is very close to the Kırkgöz water sources. It was discovered in 1990 by the speleologist P. Lacroix; a member of the Karain excavation team. The discovery of the cave; which is completely closed; was based on the discovery of two carob trees in front of the cave; hence the name Boynuzluin (Tay Projesi, 2023).

e. Öküzini Cave

Öküzini Cave is located within the borders of Yağca Neighbourhood of Döşemealtı. It is close to Karain Cave. It was first discovered and excavated by Prof. Dr. İ. Kılıç Kökten in the 1950s. The cave was named after an engraving of an ox found on the cave wall (Kartal, 1999). Besides these caves, there are other noteworthy sites (Suluin, Macarini, Deliktaş, Koyunini, Kireçini, Balcak-I and Balcak-II caves and rock shelters) related to the Late Upper Palaeolithic and Epi-palaeolithic periods (Kartal, 1999) (Figure 4).

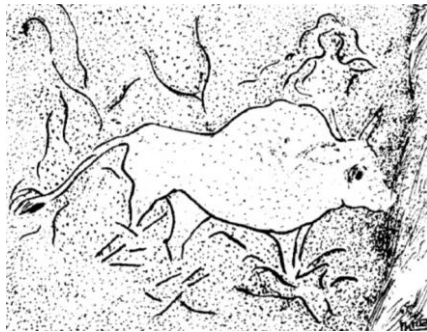


Figure 4. a. Ox Engraving on the Cave Wall b. Grave (Department Archive, Kartal, 1999)

3.1.2. Ancient Cities

a. Termessos Ancient City: Termessos is located in the northwest of Antalya, within the boundaries of the Termessos National Park of Güllük Mountain, about 35 kilometres from the city centre. The city was built on a mountainous terrain starting at 908 metres above sea level and reaching 1254 meters. It is stated that the city dates back to the third millennium BC, that Arrianos mentioned it for the first time in his chapter on the Asian campaign of Alexander the Great and that Termessos gained its true urban identity in the Hellenistic Period. Today, the oldest structures in the city that can be dated with certainty are the stoas of Osbaras and Attalos, the great theatre and the Pan Temenos built in the Hellenistic Period, but Lanckoronski mentions the existence of graves and an inscription dating to the IV, III and II centuries BC. It is stated that the additional walls were fortified in even earlier periods and the oldest of them was influenced by the Hellenic Civilisation. Since there was no need to completely enclose the settlement area, which was naturally protected by its geographical location, walls were built only to the east of the hill on which it was located (Kürkçü, 2016) (Figure 5).



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a

b

Figure 5. a. Amphitheatre of the ancient city of Termessos and b. Rock tombs in the ancient city of Termessos (Original Photo: Gül, 28/08/2021).

b. **Ariassos Ancient City:** The city of Ariassos is located 56 km northwest of Antalya province at an average altitude of 900 to 1050 meters. In 1988, S. Mitchell & M. Waelkens (1989, 66) dated the foundation of the city to this period, i.e. 189/188 BC, based on the Hellenistic city centre, where grave inscriptions, Bouleuterion and Prytaneon were found after the first survey in the city. Among the buildings constructed in the expanding city during the Roman Period are the monumental fountain (nymphaeum), gymnasium and baths, which were fed with water brought by an aquaeductus from a spring above the village of Akkoç, 3 km south of the city. According to Mitchell, two cisterns for storing the water for the bath complex, supplied by the aquaeductus, are located in the square in front of the nymphaeum. It was placed under the floor in the west (Kürkçü, 2015) (Figure 6).



Figure 6. Ariassos Ancient City: (Döşemealtı Municipality, 2016)

c. **Anydros - Eudokias Ancient City:** Eudokias is located 17 km northwest of Antalya city centre, on the plain (Düzlerçamı Plain) where Yukarı Karaman is located today, on the western edge of the Pamphylia Plain in Antiquity, on the Antalya- Korkuteli highway. In the 19th



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century, L. A. O. de Corancez (1809, 1812), Ch. Texier (1834, 1836), T. A. B. Spratt and E. Forbes (1842), A. Schönborn (1842), E. Th. Daniell (1842), E. J. Davis (1872) and J. Seiff (1872) are known to have visited the city. According to modern travellers and researchers, the ancient settlement has two necropolises, one in the east (around Evdirhan) and the other in the south (between the southern road and the Kuruçay stream bed in the west). The dominant grave type in the necropolises is Termessos-type sarcophagi with shields. Another grave type is the monumental tombs. The large and small tumuli formed by piling travertine rubble stones, the two largest of which are in the eastern necropolis, first identified by Italian researchers Paribeni and Romanelli, are also one of the common grave types of the region. According to H. Rott; between 421-431 A.D. it was named "Eudokias" in honour of Aelia Eudoxia, the wife of Emperor Arcadius, and gained the status of a city (polis) within the territorium of Termessos. The city was counted within the united province of "Lycia and Pamphylia", which is known to have been founded in 74 AD. In 313, when Lycia and Pamphylia were separated from each other and turned into independent provinces, it remained within the borders of the province of "Pamphylia". The most distinctive feature of the ancient settlement in terms of urbanism is that it is an open settlement without a city wall around it and that it lacks an acropolis. This feature of the settlement is an important indication that it was not an independent settlement, but a rural-agricultural settlement located within the territory of a fortified main city where its inhabitants could take shelter when necessary (T.C. Antalya Valiliği. (2023).

3.1.3. Historical and Archaeological Structures

a. Bademağacı Mound: The mound was excavated in 1993 and is an archaeological site located 2,5 km northeast of Döşemealtı District, 5 km north of Çubukbeli Strait. The former name of the mound is Kızılkaya. It is located on a small plain with a length of about 8 km and a width of 6 km surrounded by mountains. The mound has a long diameter of 210 m in the north-south direction, a short diameter of 110 m in the east-west direction and the height of the highest point of the mound is 7 meters (Duru, 1996) (Figure 7).



Figure 7. Bademağacı Höyüğü (Kızılkaya) Excavations 1993 Study Report (Duru, 1996).

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b. Üstünağzı Ruin

It is located on the northern foot of Mercimek Mountain where the old village of Üstünağzı was situated. In the Üstünağzı settlement; which the ancients called "Melli Asarı", there are ruins spread over a wide area around the ruins of the building where large block stones were used; giving the impression that it was a temple or heroon (monumental tomb structure), and ancient graves concentrated on the lower hill to the north (Ercenk, 1992) (Figure 8).



Figure 8. Üstünağzı Ruin, (Original Photo: Öncü, 28/07/2023).

c. **Evdır Han Kervansarayı (Caravanserai):** Evdırhan was built by the 1st Izzeddin Keykavus Bin Keyhusrev in H. 607-616 / M. 1210-1219. It has a rectangular plan close to a square with a size of 67x55 square metres. All of the body walls are of cut stone and the upper cover is of rubble stone. The portal of the building in the group of han (inns) with four "eyvan" is especially remarkable. It is idle today. Restoration works are ongoing to revitalise Evdırhan (Türkiye Kültür Portalı, 2023) (Figure 9).



Figure 9. Evdır Han (Türkiye Kültür Portalı, 2023).

d. **Kırkgöz Han:** It is located 30 km from Antalya-Burdur motorway. It is within the borders of the Bıyıklı Neighbourhood of Döşemealtı District and in the Pınarbaşı location. The inn takes its name from Kırkgöz, the old name of the Döşemealtı district. The name Kırkgöz was given because there are many water sources in this region. Like Kırkgöz Han, the lake



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where the spring waters accumulate also got its name from here. The building, which has a water source nearby, is located on a plain. Kırkgöz Han, which is today among agricultural lands, is on the Antalya - Isparta caravan route of the Anatolian Seljuk Period and is considered to be a range point continuing as Evdir, Kırkgöz, Susuz, İncir Han. The inscription of Kırkgöz Han is placed on the entrance door, in the centre of the arch keystone and measures 0.50 x 1.10 m. The inscription is enclosed in a rectangular frame and has six lines. According to the name mentioned in the building inscription; it was built in 633-644 AH (1236-1237 AD) by the Anatolian Seljuk Sultan Gıyaseddin Keyhüsrev II. (Yurdasever, 2011).



Figure 10. Kırkgöz Han, Han Entrance Gate and Han Interior (Original Photo: Öncü, 28/08/2021).

e. **Historical Ancient Döşeme Boğazı:** For Rome, road networks are considered one of the most important symbols of its sovereignty and one of the instruments of power. All Roman emperors attached great importance to the construction of better and shorter roads, road maintenance and inspection to be able to learn about what was happening in the lands under their sovereignty as soon as possible. It has been determined that the courier organisation (cursus publicus), which carried news from the provinces to the central administration, provided the opportunity to manage the whole empire from Rome (Figure 11).

According to Prof. Dr. Sencer Şahin, as shown in the road guide monument found in Patara in 1994, Emperor Claudius, immediately after the provincialisation of the region in 43 AD, had 67 routes connecting the cities of Lycia built through the first Governor Quintus Veranius and had their distances measured one by one. The 2000-year-old ancient Döşeme Road in the Döşeme Boğazı within the borders of Kovanlık Neighbourhood, which is in very good condition, is one of the oldest roads of strategic importance connecting the cities of Lycia, Pisidia and Pamphylia, especially the cities of South and South East (Çekirge, 2014). It is located at the northern foot of the Mercimek Mountain at the western end of the Döşeme Strait. A few kilometres east of Ariassos, located at the northwestern end of the Çubuk Strait, which the ancients called "Melli Asarı", is the Üstünağzı Ruin. It is the place where the Döşeme Boğazı road, which connects Antalya Port to Western and Central Western Anatolia, gets rid of the stream bed through which it passes and reaches the high plain, where it is divided into lines extending in different directions, that is, fork (Ercenk, 1992; Varsak Belediyesi, 2007).

From the remains and milestones found at certain points of the ancient road of Döşeme; it was determined that the roads were controlled by establishing military centres that controlled the



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traffic on the roads. Due to the geographical characteristics of the region; very few trade and transport routes were established. It is stated that the smallest conflicts on these roads, which are very sensitive and constantly monitored, cause the road traffic to stop (Takmer & Önen, 2008).

It is understood from the inscriptions on the milestones that the ancient Roman road called "Via Sebaste", the earliest date of which cannot be determined exactly, was built by Augustus (Octavius), who was emperor for forty years, especially to combat Kilikyalı (Cilician) pirates. One of the 3 milestones recovered from Döşeme Boğazı shows that the road in question was built by Augustus through Cornutus Arruntius Aquila, the governor of Galatia Province, in 6 BC and was named Via Sebaste (Takmer & Önen, 2008; Varsak Belediyesi, 2007). It is stated that this road, known as "Via Sebaste", was built by Emperor Caesar Augustus, the son of God (Lulius Caesar) and that the construction was supervised by the Governor (legatus pro praetor) Cornutus Aquila. The 139 mil caput viae (starting point of the road) given on the milestone found in the Döşeme Boğazı indicates that Pisidia Antiokheia is located in Isparta / Yalvaç (Ercenk, 1992; Varsak Belediyesi, 2007).

The archaeologists who deciphered the milestones of the paved road have enlightened the history of the region. Starting from Pisidian Antioch (Yalvaç), Neapolis (Şarkikaraağaç), Hüyük, Iconium (Konya), Mithia (Beyşehir), Side, it is emphasised that it was built in 6 years BC and especially after circumnavigating the Beyşehir Lake, one branch extends to Syedra and the other to Antiocheia and Osione via Tarsos, that is, Syria and Mesopotamia (Çekirge, 2014).

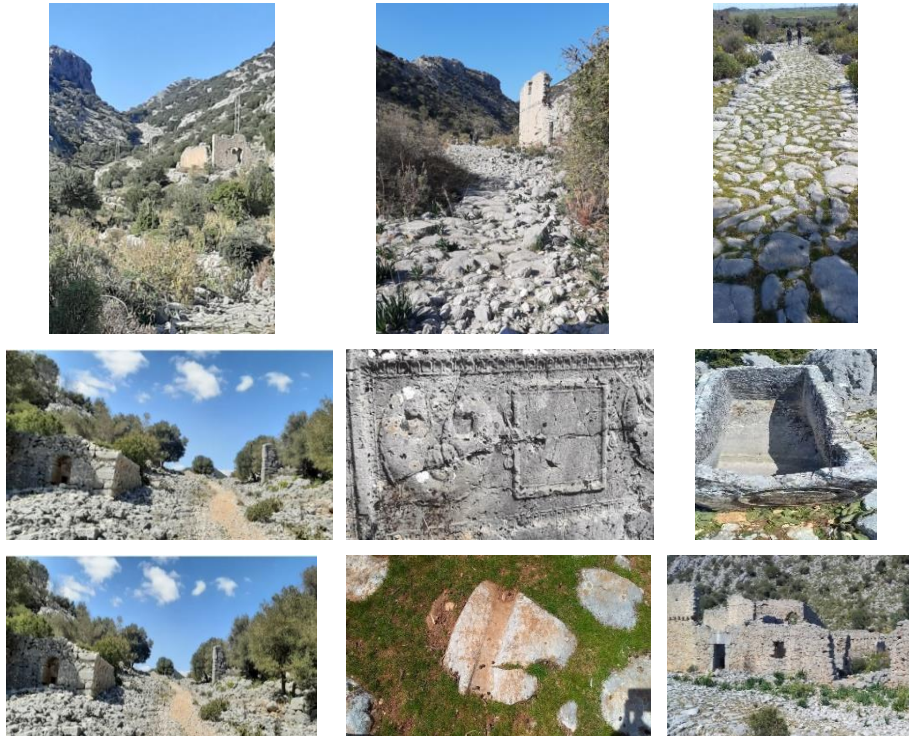


Figure 11. The Sarcophagus was found in Döşeme Boğazı, Adrova Mevkii and on the road (Original Photo: Öncü & Gül, 20/03/2022).

e. Water Cisterns



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Cisterns are water storage structures that were reached as a result of the research on the method and form of storing rainwater due to the lack of spring water and low groundwater level, and their usage features were developed over time.

Due to the geographical location of the Döşemealtı Region, the ancient cities in the region the ancient "Döşeme Boğazı (Strait)" road and the water cisterns built by the Yörükler (Yoruks) on their migration routes are important cultural values. The scarcity of water resources in high regions, which receive abundant rainfall due to their characteristics and thus should be in good condition in terms of water availability, has enabled the development of rational solutions for finding and storing water, thus ensuring the continuation of life without interruption (Ercenk, 2012).

It was observed that the well clusters and cisterns seen in the Döşemealtı region were concentrated on or in the close vicinity of thousands of years old road lines that provide access to production and trade areas; to solve the problem of finding and storing the water required during transportation (Ercenk, 2012). The architectural diversity and number of cisterns seen in the Döşemealtı plain are remarkable. Although it is correct to attribute the presence of a large number of cisterns to animal breeding in a region where thirst is almost registered, it is insufficient. On the other hand, the fact that cisterns and wells of various models and densities are not encountered except for a few examples in the distant and close neighbourhoods, which are engaged in nomadic animal husbandry and have cultural ties with the region, shows that the cisterns on the Döşemealtı plain are unique. The "water storage structures", which are unique to the region dating back to the periods before the nomadic life, have been used until today with some changes in their form and volume and restoration when necessary (Ercenk, 2012). (Figure 12, 13,14,15).



Figure 12. Cistern of Kömürçüler Neighbourhood and Other Cisterns in Kömürçüler Neighbourhood and Interior Surface (Original photo: Fadime Öncü, 20/03/2022).

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Figure 13. Ayanlar Neighbourhood Cistern and the other Cistern located in the Çıtlık tree and Çubuk waist, have an important value for Yoruks (Original Photo: Öncü, 20/03/2022).



Figure 14. Çıplaklı Neighbourhood Cistern and Cistern Interior (Original Photo: Öncü, 21/03/2022).



Figure 15. Dağbeli Neighbourhood Cistern (Original Photo: Öncü, 21/03/2022).

3.1.4. Protected Areas

Human-made artefacts of exceptional universal value in historical, aesthetic, ethnological or anthropological terms, or common artefacts of nature and man, and areas covering archaeological sites.

Archaeological Sites: Kovanlık Neighbourhood, Ancient Döşeme Boğazı Derbenti and Gözlek Hill, Sulu Obruk and Göçyolu Locations around the Ancient Road, Archaeological remains such as the ancient road section, building remains, Khamasorion tombs, sarcophagi, observation post, Döşeme Boğazı and Ancient Road, Termessoss Ancient City, Kırkgöz Water Springs, Yagca Village, Ariassos Ancient City in Akkoç Village. **Other Archaeological Sites:** Dağbeli Neighbourhood İncirlik Mevkii (1st Degree Archaeological Site), Düzlerçamı Mahallesi Yukarıkaraman (1st Degree - III. Degree Archaeological Site), Near Uzunkuyu Cistern,



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Düzlerçamı Mahallesi Yukarıkaraman (1st Degree Archaeological Site), Ancient Water Canal, Düzlerçamı Mahallesi Evdirhan and its immediate surroundings, the area where the Tumulus is located just west of Evdirhan (1st Degree Archaeological Site), Ancient Water Canal, Evdirhan and its immediate surroundings in Düzlerçamı Neighbourhood, the area where the Tumulus is located just west of Evdirhan, (1st Degree Archaeological Site). (Vuruşkan & Ortaçşme, 2009; ÇSİB, 2018).

Natural Protected Areas; Düzlerçamı Forest, Pigeon Cliff, Termessoss Ancient City and National Park, Kirkgoz Water Springs, Harunini Cave, Kizilin Cave, Oxenini Cave, Koyunini Cave, Mustanini Cave, Macarini Cave, Carkini Cave, Suluin Cave, Church Duden Cave Tabak 1 and Tabak 2 Caves etc. (Vuruşkan & Ortaçşme, 2009; ÇSİB, 2018).

3.1.5. Traditional Architecture: There are many examples of traditional civil architecture in the Döşemealtı Region, which are included in Intangible Cultural Values, but most of them are abandoned or idle. There are no registered traditional civil architecture dwellings (Figures 16, 17, 18, 19).



Figure 16. a. Dağbeli Neighbourhood Traditional Architecture, b. Kömürcüler Neighbourhood Traditional Architecture (Original Photo: Öncü, 2022).



Figure 17. a. Karaveliler Neighbourhood Traditional Architecture, b. Killik Neighbourhood Traditional Architecture (Original Photo: Öncü, 2022).

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Figure 18. a. Camili Neighbourhood Traditional Architecture, b. Interior Architecture (Original Photo: Öncü, 2022).



a

b

Figure 19. a. Traditional Architecture of Ekşili Neighbourhood, b. Interior Architecture (Original Photo: Öncü, 2022).

3.1.6. Local Handicrafts

Based on Cultural Heritage, it is important to preserve and transfer the thousands of years of local handicrafts, which are one of the living cultures that create and develop this richness, and the accumulations that will inspire the future. The history of Traditional Turkish Handicrafts dates back to ancient times, in Central Asia. The characteristics of nomadic life, which is a way of life in handcraft products, are also understood from historical remains. Embroidery and motifs were applied to tents, carpets, rugs, saddle sets, dresses, etc. in that period. Turks living in Anatolia have left historical traces by reflecting this rich and diverse art and civilisation cultures. (Öncü, 2013). The Turkish tribes who settled in the Döşemealtı region continued to develop and develop the nomadic culture embroidery and arts of Central Asia here.

In Döşemealtında, while many handicrafts were made, most of these arts have been lost, and weaving, which continues to decline today; Halıcılık (Carpet weaving), heybe (saddlebag)



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weaving, çarpana (Multiplier), yün çorap örme (Wool Sock knitting), hasır örme (Wicker Knitting), etc. It still comes to life in the hands of the last representatives of the professions. The lack of apprentices who will continue these art branches for economic reasons accelerates the disappearance of these professions.



Figure 20. Traditional Weaving Samples Detected in Döşemealtı Neighbourhoods (Original Photo: Öncü, 2022).



Figure 21. Women Weaving Straw in Döşemealtı Ayanlar Neighbourhood (Original Photo: Fevzi Ayçiçek, 2022).

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Figure 22. Akkoç Neighbourhood Multiplier Weaving and Çığlık Neighbourhood Wool Sock Knitting (Original Photo Fadime Öncü,2022)

3.1.7. Döşemealtı Carpets

Döşemealtı Carpets take its name from the region where it is located. According to the information obtained from the local people, the first Döşemealtı Carpet was started to be woven by Karakoyunlu Yörükleri (Yoruks) who settled in Kovanlık Village and New Ottoman Yörükleri (Yoruks) who settled in Aşağıoba village and spread to other villages of Döşemealtı.

In Döşemealtı carpets, 7 different colours are used: red, yellow, green, blue, dark red, black and white. The weft and warp of the carpets are made of wool yarn. Root Dye Plants: Root Dye, Sumac Plant, Sey, Ezentere, Lemon Salt, Sakızlık, Ash Water to be obtained from the ashes of any Oak and Acorn, Lemon Peel, Indigo, Root of Dried Labada Plant, Walnut Shell, Cattail, Acorn, Ironoxide (Mazıbaş, 2014).

Classification of Döşemealtı Carpets according to their models: 1– Halelli, 2- Dallı (Branched) (Tree of Life), 3– Toplu (Bulk), 4- Toplu terazili (Bulk Scale), 5– Mihraplı, 6– Akrepli (Scorpion), 7- Koca sulu (large watery) (Mazıbaş, 2014).

Classification According to Edge Motifs: 1- Tutmaç (Handle): Beştaş (five stones), Yıldızlı top (a Starry Ball), Bıçak ucu (Knife Tip), and Tutmaç. 2- Kocası Yanır (Fold): Koç Boynuzu (Ram's Horn), Beş Parmak (Five Fingers), Kara Saban Demiri (Black Plough Iron), El Hayası (Hand Haya) motifs. 3- Develi Su: Deve ve çalı (camel and bush motifs). 4- Kenar Suyu (Edge Water): Keme dişi (Keme tooth) and Öküz sidiği (Ox urine) motifs. 5- Albay Suyu: (Albay Water): Elmalı Suyu (Elmalı Water) and Kazak Suyu (Kazak Water) (named after the Kazak Carpet brought from Kazakhstan by a retired colonel) motifs (Mazıbaş, 2014).

Classification according to size: 1- 2 m x 3 m size Floor Carpet, 2 - 1.26m x 1.83m Large Carpet 3 - 0.80m x 1.25m Namazlık (Prayer Rack) (Çeyrek=Quarter), 4 - 0.75m x 3m Yolluk (Runner), 5- 0.40m x 0.80m Divan Yastığı (Divan Pillow) (Topan). The number of knots of the Döşemealtı Carpet is counted from the back of the carpet per cm² or dm² (Mazıbaş, 2014).

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Figure 23. Traditional carpet weaving examples detected in Döşemealtı Neighbourhoods
(Original Photo: Öncü, 2022).

3.1.8. Döşemealtı carpet fields:

Carpet fields were first established in Killik Neighbourhood of the Döşemealtı District of Antalya Province in Türkiye and are still being continued today with 40-50 thousand pieces of weaving (Ekin, 2021). In the rented fields they use, they start on 22 June every year and are kept under the sun on 20 September. The weavings that come in winter are washed and put in warehouses to prepare them for the next season. It was stated that trials were made in certain parts of Türkiye, but no successful results were obtained and the reason for the success only in this region in Türkiye is the dew fall. Because when it is laid in the sun in a place where dew does not fall, it is stated that the sun burns the weavings, that is, blackens them.

Especially hand-woven carpets are laid on barren and slightly stony soil to be processed in the carpet field. The stones in the soil act as insulation and ensure that the soil does not lose heat. Thus, the soil causes the colour of the carpet to fade, that is, to pastelise. The sun does not affect the carpets and rugs woven with root dye. The weavings made with root dye are sunbathed against pests, moth-eaten or old places are repaired and offered for sale especially in Istanbul (Oral interview with Hasan Topkara, 2021) (Figure, 24, 25).



Figure 24. Interview with Hasan Topkara, owner of a carpet field in Döşemealtı Killik Neighbourhood (Original Photo: Öncü, 2021).



Figure 25. Carpet field located in the Döşemealtı Karaveliler Neighbourhood (Original Photo: Öncü, 2021).

3.1.9. Traditional clothing culture

The clothing of society carries value judgements, aesthetic views, artistic and many cultural elements. The constructive laws of nature, which are included in the Cultural Heritage, combined with human talent, and the clothes shaped according to their beliefs, tastes and emotions, with their apparent values, have created differences according to the way of view of the society in which they find themselves.

In this period when global culture makes itself felt in every field, Döşemealtı clothing culture with its traditional and original structure, has been going on since ancient times and has started to disappear today; It has a structure that will bring a lot of information and visual data about the old cultural structure of this region to our cultural history. The local clothes belonging to the Döşemealtı region are still common today except for a few neighbourhoods and are worn by women and girls when the henna night is held. It was observed that men's clothes have the same characteristics as the Antalya centre.

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Figure 26. Döşemealtı: Camili and Karaveliler, Kömürcüler, Düzlerçamı Neighbourhoods traditional women's clothing (Original Photo: Öncü, 2022).



Figure 27. Döşemealtı: Traditional Women's Clothing of Ekşili, Akkoç and Kovanlık Neighbourhoods (Original Photo: Öncü, 2022).



Figure 28. Döşemealtı Karataş Neighbourhood Thessalian Immigrants and Traditional Women's Clothes (Original Photo: Öncü, 2022).



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3. CONCLUSION and RECOMMENDATIONS

In this study, Döşemealtı District has been analysed in terms of cultural heritage and sustainability. As a result of the examination, it has been observed that there are very important values in terms of these issues. However, when the importance given to traditional cultural values within the scope of cultural sustainability in Döşemealtı is analysed, it is seen that ecology and sustainable environment issues are not given the necessary importance.

Although Döşemealtı District has very important values such as cultural heritage and sustainability, it has been determined that the relevant administrators do not pay due attention to cultural memory for the transfer to future generations.

The increase in migration from rural areas due to economic, social and political factors in the Döşemealtı region, the change in traditional lifestyle, and the lack of importance and indifference by managers and decision-makers led to the gradual loss of Cultural Heritage Values and functions.

Despite all these negativities, it has been observed that some cultural values continue in tangible and intangible cultural heritage items (Handicrafts, traditional food culture, traditional clothes, traditional life, etc.), which are among the sub-headings of cultural heritage and are not directly related to the subject of cultural heritage.

As a result of the content analyses, the following suggestions can be made to protect the cultural heritage in Döşemealtı region and to ensure its sustainability;

- The Ministry of Culture and Tourism, Municipality, Universities, ICOMOS (International Council on Monuments and Sites) which is an international and non-governmental organisation, NGOs and other stakeholders should act together to create a holistic strategic action plan for Döşemealtı Region.
- A holistic natural and cultural inventory of the Döşemealtı region should be prepared, digitised and updated in a GIS environment.
- Scientific research and projects should be produced in cooperation with relevant stakeholders.
- Local Authorities should be provided with more effective and competent opportunities for the protection and sustainability of cultural heritage.
- It should be obligatory to establish a protection, implementation and supervision bureau "KUDEB" within the Municipality by permitting Döşemealtı Municipality the Ministry to carry out the procedures and applications related to immovable cultural and natural assets that need to be protected and to carry out their inspections. This will contribute to the promotion of Döşemealtı District in terms of destination tourism. The Ministry of Culture and Tourism should request quarterly reports to follow up on the work carried out by the relevant institutions.
- The aim of conservation with a participatory approach in sustainable management is not to isolate the value from the society, but to bring the value to the society and to ensure that it takes place in cultural and social life and that the Cultural Heritage value contributes to economic and social development.



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- Cultural heritage awareness and consciousness-raising activities should be increased among local people.
- The fact that the traces of Döşemealtı Ancient Bosphorus are still partially preserved is of great importance for the protection and survival of this road as a cultural heritage value.
- The artefacts that constitute cultural heritage or cultural heritage, which have been preserved from the past to the present and created by previous generations and believed to have universal values, should be brought back to the society without isolating them from the society within the participatory approach in sustainable management, and it should be ensured that cultural heritage values contribute to economic and social development.

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FURNITURE DESIGN COURSE STUDIO STUDY: LIGHTWEIGHT FURNITURE DESIGN

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ABSTRACT

Furniture is an element that meets the basic needs of users and offers comfort and aesthetics to the user. Furniture design is shaped under the influence of various factors from the first stage. When designing furniture, there is a long process from the emergence of the first idea to the use of the furniture. With the furniture design courses given in interior architecture departments, students experience the furniture design process in the studio. For this purpose, the concept of lightweight furniture was discussed within the scope of Furniture Design II course conducted with third year students of Akdeniz University, Faculty of Architecture, Department of Interior Architecture and 24 of the resulting products were included in the study. In the study, it was expected that the furniture suitable for the definition of lightweight furniture should be easily portable and suitable for sitting comfortably. The study contributes to students' learning by doing and the process was completed in 3 stages: designing, planning and production. The design and planning phase consists of concept and form determination, while the production phase consists of material selection and obtaining the final product. The furniture designed in this context were produced in different forms according to their concepts, using lightweight materials such as aluminum, beech wood, ayous wood in one-to-one dimensions. Thus, students both interpreted the form by using the material and experienced the production process of the furniture they designed during their education process.

Keywords: Furniture, Concept, Material, Lightweight Furniture, Design Education.

1. INTRODUCTION

If we examine the etymology of the word furniture, the Latin word "mobilis" (moving) was adapted to the late Latin word "mobiliaria" (movable). The word "mobiliara" is adapted to the French word "mobilier" (a movable object) and used as the word "mobilya" in our language (Karabıyık, 2009). Although the word furniture means a mobile object that can be moved, it is generally accepted as an equipment element (Tütüncü, 2011). Furniture can be defined as safe



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and comfortable designed items that address people's basic physical needs (such as sitting, sleeping, working and storage) as well as social and cultural dimensions (Çetin, 2022). Furniture is a functional item that appeals to people's tastes in a place where they spend time during the day or can be used to equip a place for different purposes according to the conditions of different periods. According to this definition, it is understood that furniture is a product in which art and technique, which have functional and aesthetic values, are combined (Karabıyık, 2009). It is also important that furniture should be ergonomic along with its functional and aesthetic elements. All of these elements should be considered together in furniture design.

Interior architecture is a profession that responds to the functional needs as well as the aesthetic expectations of the user and uses technical information to create the most suitable environment (Berdi Gökhan & Atasoy, 2005). Furniture is one of the most important elements of interior design. Interior architects should have a sufficient level of knowledge about furniture. This knowledge includes material properties and production knowledge (Altın, 2016). Experiencing the production process also contributes to the problems that will arise in the process and the solutions that will be developed to overcome these problems.

The aim of interior architecture education is not only to transfer knowledge to students. Among the primary goals of design education is that students should try to adopt the understanding of how they can improve themselves in their education and benefit from the education process at the highest level (Çetinkaya, 2014). Interior architecture education consists of a curriculum in which practice courses are predominant. One of the practical courses in interior architecture education is the furniture design course. As suggested by Chikering and Gamson (1987), the educational model where students sit in the classroom and listen to their teachers' lectures is not suitable and effective for architecture. However, it is pointed out that active learning will yield positive results when students are the main participants in the learning process (Keyser, 2000). In this framework, in 1915, John Dewey and Evelyn Dewey proposed "learning by doing", an educational model that can increase students' interest and attention, and this model has an important place in architectural education. The student who endeavors to learn by doing and tries to create a product benefits from the process of "designing, making and producing" that takes place simultaneously with the goals of his/her education. Students generate solutions to the challenges encountered in the design and construction processes. The learning-by-doing approach plays an active role in the search for materials and the planning of the building process, acting as a bridge of experiential knowledge between theory and practice (Mun & Arslan Selçuk, 2018). Learning by doing brings together two different types of knowledge that can and cannot be transferred to students in the studio. It also contributes to students' creativity as they take part in an interactive learning style through the learning-by-doing method.

Students' personal experiences with furniture production are important to understand that the conceptual approach to design, as well as the materials and production techniques during the production phase, can change the design unexpectedly. In the design education approach, production proceeds independently of design and conceptual infrastructure comes to the fore. Many issues related to furniture design and production such as materials, production methods and details cannot be evaluated in the education process. To find a solution to this situation, an educational approach that combines furniture design with production is needed (Altın, 2016). It is necessary to use methods and techniques that will positively affect learning in design education, where practical courses are weighted.



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2. MATERIALS and METHOD

2.1. Materials

The material of the study was selected by the students among the works designed within the scope of the Furniture Design II course in the Fall Semester of the 2022-2023 academic year. At Akdeniz University, Faculty of Architecture, Department of Interior Architecture, 105 students took İÇT 343 Furniture Design II course in the fall semester of 2022-2023. Among these students, 63 students were able to produce a final product. 24 students' final products were selected because they fit the definition of lightweight furniture (Table 1).

Table 1. Students whose products are included in the study

Students whose products are included in the study	
Mehveş Bengüsu Helvacı	Mustafa Oğuzhan Eker
Mert Can Ercan	Asmar Suleymanova
Hatice Kaya	Aslı Çalışkan
Mustafa Karabulut	Merve Yıldırım
Elif Emine İris	Burakcan Becerikli
Melis Şenoğlu	Ezgi Yön
Asmar İbrahimova	Tuğçe Ayvaz
Didem Al	Selin Ataş
Umut Yıldırım	Ebrunur Sarıkaya
Fatoş Melis Mazılıoğlu	Ayşe Feyza Tekin
Azat Gündem	Melisa Kul
Belkıs Gümüş	Berçin Ece Kirazcı

2.2. Method

Within the scope of the Furniture Design II course conducted in the 2022-2023 Fall semester at Akdeniz University Faculty of Architecture, Department of Interior Architecture; students were asked to create a furniture design that would define "Lightweight Furniture". In the formation of furniture design, problem, information gathering, alternatives, evaluation and production stages were followed (Acar & Bekar, 2017; Akyol, 2006).

The design process followed in the Furniture Design II course is as follows:

- *Problem:* Designing a seating element that is suitable for the concept of lightweight furniture, easy to move and comfortable to sit on
- *Information Gathering:* Creating a concept and scenario. What kind of shape will the furniture be in? What kind of ergonomic solution will they need to produce suitable for this form? How will it make the furniture feel lightweight? seeking solutions to questions such as

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- *Alternative:* Creating more than one design with sketches and 3-dimensional narratives. (While creating alternatives, the necessary information was taken from the feedback, information collection and concept stages.)
- *Evaluation:* Preparation of 2D drawings, graphic descriptions, 3D descriptions, material details, and joint details of the final product
- *Production:* Production with real material in 1/1 scale

3. FINDINGS and DISCUSSION

The lightweight furniture was evaluated in 3 stages in accordance with the learning-by-doing method; interpretation of the design through a concept (concept development), material selection, and evaluation of the final product produced in one-to-one scale.

3.1. Concept Development

In the concept creation phase, students are expected to put forward their design strategies according to the topic of "lightweight furniture". While the concept was being developed, it was requested to design a seating element that is suitable for the concept of lightweight furniture, easy to move and comfortable to sit. At this stage, students created their scenarios by collecting information appropriate to the problem (Table 2). During the concept development phase, it was discussed with the students whether the concept of lightness could be defined as weight only or whether the furniture would be suitable for the definition of lightweight furniture by using spaces in the furniture.

Table 2. The concept stage of the students



Student: Hatice Kaya



Student: Elif Emine Iris



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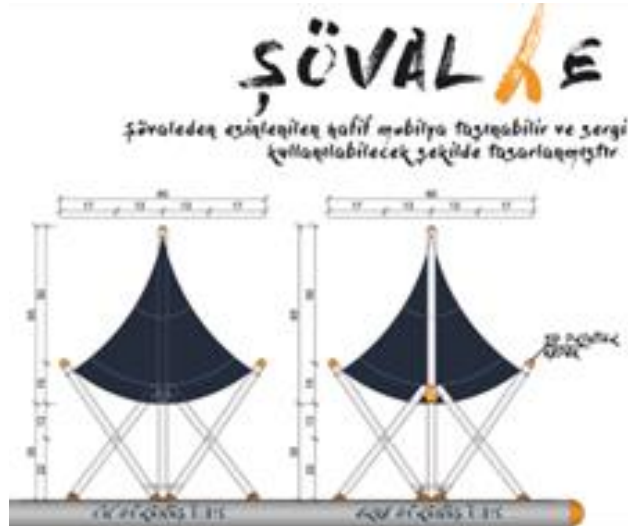
Student: Mustafa Karabulut



Student: Melis Şenoğlu



Student: Mehveş Bengüsü Helvacı



Student: Mert Can Ercan

At the concept stage, it was expected that the furniture to be designed would be able to meet the needs. In this process, it is important what else the user may need and how value can be added to the product. After the definitions of the furniture were made, visual studies and sketches began to be drawn. The most appropriate one among alternative concepts is selected and detailed. This process allows the designer to proceed in a more controlled manner and to achieve a more concrete and understandable result.

3.2. Material Selection

Within the scope of the study, students' choice of materials suitable for the concept of lightweight furniture constitutes an important stage of the study. At this stage, it has been revealed which materials will benefit due to which properties.

Students decided on the forms of their furniture according to the limitations of the materials they researched (Figure 1). In addition, students experimented with joint details according to

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the properties of the materials. The choice of material in the study enabled the students to discover the material and caused the designs to progress as the materials allowed.



Figure 1. Furniture designs at the material selection stage

As a result of their research, the students suggested the following materials for use in furniture design (Figure 2):

- For its structure; aluminum, chrome, beech wood, ayous wood.
- For its upholstery; tarpaulin, sunbed fabric, artificial leather, upholstery linen, wicker rope, polyurethane waterproof fabric, knitted rope, upholstery sponge, transparent pvc.
- For its joints; 3d printer, allen screw, bolt, nut, lift lid scissor mechanism, hinge, special fasteners.

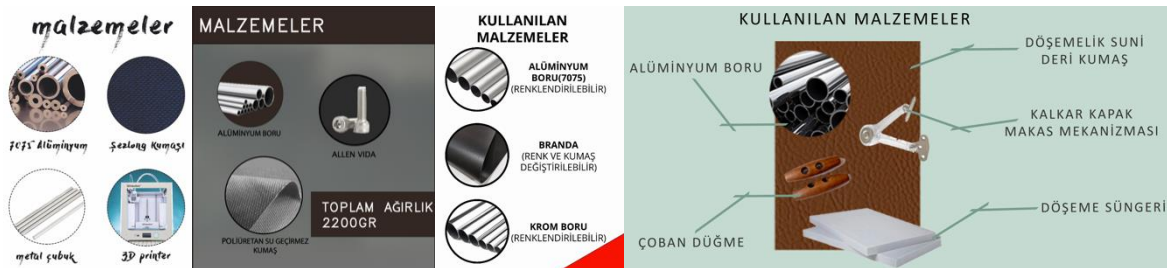


Figure 2. Some of the materials that students use

The reason why the majority of students choose aluminum for the structure of furniture is that it is light in weight. They wanted the furniture to reflect the lightness visually by using various types of rope such as wicker rope, knitted rope for furniture upholstery. In addition, they have used folding, disassemble-install mechanisms in their furniture for easy portability of lightweight furniture.

3.3. Final Product Produced in One-to-one Scale

Students started the process of creating products on a 1/1 scale with the data obtained from the previous stages. As a result of the concept, sketch drawings, 2D drawings, 3D modeling, model trials and material selection they started to produce furniture in one-to-one scale (Figure 3). First, they provided the supply of the materials they selected. During the production phase, they cooperated with masters in the industry to bring their designs to the appropriate form according to the limitations of the selected materials. They had the opportunity to learn the joint details of the furniture by seeing them on a one-to-one scale.



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Figure 3. Furniture should be lightweight and easily portable

Students optimized the resulting products in terms of function and aesthetics within the determined constraints. As a result, qualified designs have emerged that have been addressed in accordance with the requirements of the furniture that students have produced one-on-one (Table 3).

Table 3. Products included in the study



Student: Mehveş Bengüsü Helvacı Student: Mert Can Ercan Student: Hatice Kaya Student: Mustafa Karabulut



Student: Elif Emine Iris Student: Melis Şenoğlu Student: Asmar İbrahimova Student: Didem Al



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Student:
Yıldırım

UmutStudent:
Mazılıoğlu

Fatoş

Melis

Student: Azat Gündem

Student: Belkıs Gümüş



Student:
Oğuzhan Eker

MustafaStudent:
Suleymanova

AsmarStudent: Aslı Çalışkan

Student: Merve Yıldırım



Student:
Becerikli

BurakcanStudent: Ezgi Yön

Student: Tuğçe Ayvaz

Student: Selin Atas



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Student:
Sarıkaya

Ebrunur
Student: Ayşe Feyza
Tekin

Student: Melisa Kul

Student: Berçin Ece Kirazcı

4. CONCLUSION and RECOMMENDATIONS

This study deals with a process that aims to provide furniture design and production experience, and it is aimed to increase student's awareness in this direction and guide future studies. In this context, the relationship between the design process and the learning-by-doing method in terms of the furniture design course and its stages are defined (Figure 4).

Firstly, it defined a more controlled area in the act of designing by giving students a concept. Students attributed multidimensional meanings to the concept of lightweight furniture. Among these meanings, the concept of weight and the definition of space have developed. In addition, portable and removable features and lightweight features are supported in the designs.

In this study, material selection played an important role in the design process, which started with collecting information and sketches in furniture design. Students were able to explore the materials needed to design lightweight furniture. It caused the designs to progress as the selected materials allowed. Students made designs with materials on a one-to-one scale. The furniture design course does not only focus on model applications but also benefits their professional development with one-to-one practice.

Students had an active and participatory experience in the planning, production and assembly stages of furniture designed with the learning-by-doing method. It is thought that the active participation of students in the application processes will contribute to their faster adaptation to business life after the university environment. However, the applied education model and this new learning experience can also be included in different courses in the interior architecture education process.

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**EXAMINATION OF AUTHENTIC RESTAURANTS IN HOTELS IN TERMS OF
INTERIOR DESIGN**

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ABSTRACT

The concept of authenticity is a term that is prominent in restaurants as well as other fields that include cultural accumulation. Interior design is seen as one of the main factors in ethnic restaurants where authenticity depends on many factors. Although the purpose of these restaurants, which have themes from many different cultures such as Italian, East Asia, Ottoman and Korean, is to create a sense of authentic place for the customer by applying authentic places, the result can be commodification. The expectation of tourists to experience different experiences has developed with the changes in the understanding of tourism; hotels, one of the important structures of the tourism sector, have also changed their understanding of content and have started to include restaurants that can be defined as authentic as a service. In this context, the hotels in Antalya, which were built or renovated in the last 3 years, and which have a restaurant designed as an "Italian Restaurant", selected among the 5-star hotels in Antalya, have been examined based on the spatial components and elements created by İlkay Özdemir (1994). As a result, the concepts of authenticity and commodification were discussed over the selected hotels, and the components and elements of the restaurant were evaluated in terms of restaurant interiors.

Keywords: Commodification, Authentic, Italian Restaurant, Ethnic, Color, Cultural Heritage, Furniture.

1. INTRODUCTION

Commodification can be defined as the alteration and trivialization of cultural values and human relationships (Cohen, 1988). Although there have been studies related to the commodification of a place with a specific cultural heritage due to tourism's integration into everyday life (Greenwood, 1977), this situation is not sufficient to answer whether the design resulting from the authentic representation of a culture in a new location is authentic or commodified. Due to increased cultural awareness, modern society has sought authenticity in consumer products and services (Gilmore & Pine, 2007). The concept of authenticity is prominent not only in fields with cultural accumulation but also in restaurants. Literature shows that the authenticity of a restaurant affects customer satisfaction, and customers who frequently visit ethnic restaurants seek ethnic cultural experiences (Bell et al., 1994). Wood and Munoz, on the other hand, describe ethnic restaurants as more than just food service establishments;



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they define them as cultural "ambassadors" that introduce foreign cuisines and the culture associated with them (Wood & Munoz, 2007). There are several factors that determine the authenticity of ethnic restaurants. Research by R. Thomas George in 2001 indicates that interior design and decoration are determining factors in the authenticity of a place (George, 2001). Ethnic restaurants have themes from various cultures such as Italian, East Asian, Ottoman, and Korean. According to one study, Chinese-themed ethnic restaurants in America are staffed by family members, have ethnic Chinese decorations and paintings, offer menus in both Chinese and English and provide Chinese cultural elements such as chopsticks and tea sets (Liu & Jang, 2009). Another study on Korean restaurants suggests that the authenticity of Korean restaurants is related to the interior and exterior design, music, and decoration, which incorporate Korean culture with furniture, colors, and music (Jang et al., 2011). While the goal in such restaurants is to create an authentic atmosphere for customers, the result can sometimes be commodification.

Changes in tourism expectations, driven by changes in tourism understanding, have led to hotels, one of the key structures in the tourism sector, altering their content and incorporating restaurants that can be defined as authentic within their premises. As an example of such restaurants, the Italian/Mediterranean-themed à la carte restaurants in 5-star hotels located in the Manavgat district of Antalya, which has the highest number of 5-star hotels in Turkey, can be cited.

Italy has a significant cultural and artistic history, with renowned artists and works in literature, especially during the Renaissance period, such as Leonardo Da Vinci, Raphael, Michelangelo, and Giotto (Vasari, 2013). According to the literature, both the Renaissance and the period after World War II played a critical role in the formation of Italian furniture design (Aksoy, 1992; Dal Falco, 2019; Dellapiana, 2018; Barisione, 2020). Until 1946, Italian design was influenced by both cultural and structural aspects of Rationalist architecture. During this period, certain raw materials, especially wood from the boxwood plant and linoleum, were frequently used due to limited resources caused by the war. According to Aksoy, in the years immediately after the war, Italians rapidly adapted to new materials and continuously used them in new furniture designs. In the 1960s, with the economic acceleration, new methods were developed, and plastic material became prominent. Although the 1970s were challenging, Italian design gained international recognition during this period. In the 1980s, the imaginative, unexpected, and alternative designs created by the Italian furniture industry opened new horizons in the international design world. Aksoy mentions new materials and usage methods such as wood, lamination, plywood, metal, and plastic during this period.

This article aims to examine whether the spatial designs of authentic restaurants within the 5-star hotels, whose numbers are increasing day by day, possess authentic or commodified qualities based on ethnic values as part of the spatial components and elements created by Özdemir (1994). This article aims to examine restaurants designed as Italian Restaurants, based on the spatial components and elements created by Özdemir (1994), and to evaluate the findings in terms of authenticity and commodification concepts.

2. MATERIALS and METHODS

In the scope of this study, 5-star hotels in Antalya that have been constructed or renovated within the last 3 years and feature an "Italian Restaurant" have been selected. The selection of Italian restaurants within 5-star hotels in Antalya was based on the criteria that Antalya has the



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highest number of 5-star hotels in Turkey and is the city that hosts the most foreign tourists in Turkey. When choosing the 5-star hotels, attention was given to the fact that they were all designed by the same project firm within the last 3 years, located in the same region, and catering to similar customer profiles. The selected hotels are shown in Table 1.

Table 1. Hotels Selected As Examples

Number	Name Of The Hotel
1	Mylome Resort Hotel
2	Seaden Quality Hotel
3	Diamond Deluxe Hotel
4	Bella Resort Hotel
5	Narcia Hotel

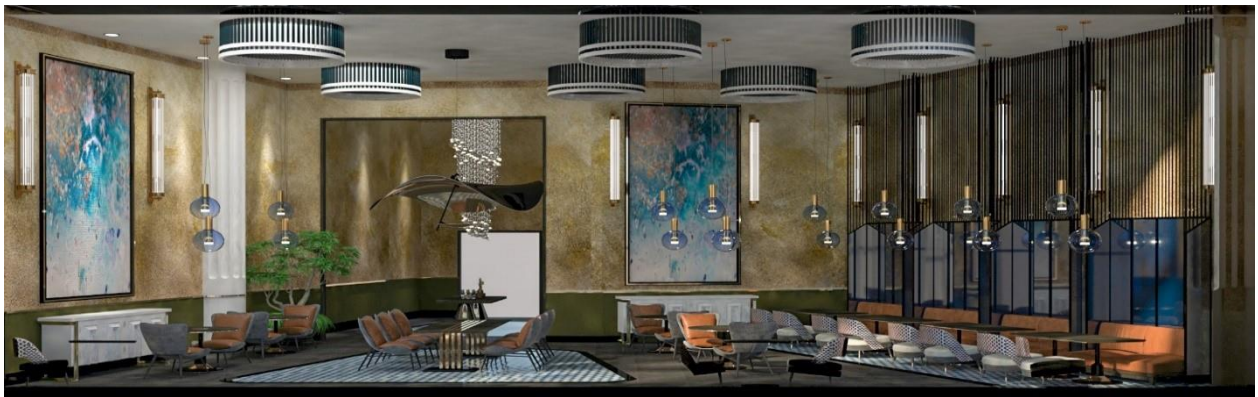


Figure 1. Mylome Resort Hotel

All of the Italian/Mediterranean restaurants in these hotels have been designed by the firm named Tuba Soner Design Office. The relevant three-dimensional visuals of the restaurants are provided below (Figure 1-4).



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Figure 2. Seaden Quality Hotel



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Figure 3. Diamond Deluxe Hotel



Figure 4. Narcia Hotel

Özdemir (1994) defines spatial components as elements that emerge during the creation of a structural space. Özdemir (1994) emphasizes that these components and elements play a significant role in the overall effect of space and discusses their divergent functions. These components are often fixed and typically assume determining and limiting roles in shaping the interior space. Spatial elements, on the other hand, are defined as concepts that take their place in the space after the formation of the structural space and are movable elements that vary according to the user's needs and desires.

In summary, Özdemir (1994) mentions that compositions are dependent on spatial components and that these components can have limiting qualities. For example, a "carpet" can serve as a solid boundary within a space, while furnishings and accessories are arranged within the boundaries of the carpet.

The spatial components identified by Özdemir (1994) include flooring, walls, columns, beams, roofs, stairs, doors, and windows, while spatial elements include furnishings, items, and accessories such as chairs, tables, and other items. These spatial components and elements will be examined with a focus on cultural history, color, and furniture as elements that indicate the authenticity of a space. The findings will be analyzed under the main headings of components and elements, with each of these categories having its subheadings.

3. FINDINGS and DISCUSSION

The study findings consist of two main categories, as identified by Özdemir (1994), within the Italian Restaurants in the hotels. The first main category is "spatial components," which includes flooring, walls, columns, beams, roofs, stairs, doors, and windows. The second main category is "spatial elements," which encompasses movable furniture, items, and accessories.

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3.1. Spatial Components

It defines spatial components as elements that emerge during the creation of the structural space. These components are fixed and mostly assume determinative and limiting roles within the interior space.

3.1.1. Flooring as a Spatial Component

In the Italian restaurant of the Mylome Resort Hotel, two different ceramics and a single type of marble are observed to be used for the flooring. Throughout the space, anthracite-colored textured ceramics dominate, while in some sections, blue and white ceramics, which can be ethnically defined, are used. These two ceramics are integrated with black marble used as a border. In the Italian restaurant of the Seaden Quality Hotel, the flooring consists of three different marbles in black, gray, and white with CNC-cut patterns. At the Diamond Deluxe Hotel's Italian restaurant, the flooring is observed to be made of black and white CNC-cut marbles, creating two different patterns, with black marble borders connecting them. At the Bella Resort Hotel, six different ceramics and two different marbles are used. Throughout the space, textured anthracite ceramics are used, while in some sections, earth-colored ceramics with Hungarian patterns are laid, and in other sections, black and white marbles with CNC-cut patterns are used to create designs. In the Italian restaurant of the Narcia Hotel, one type of ceramic and two different marbles are observed to be used. White marble is used throughout the space, with black marble serving as a border, and in some areas, textured anthracite-colored ceramics are used (Figure 5).

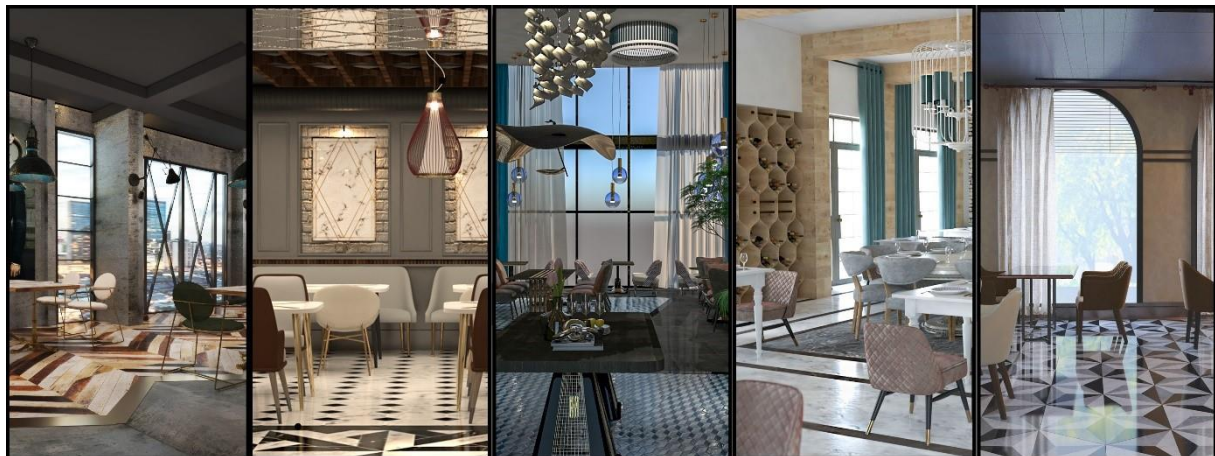


Figure 5. Floorings From A'la Cartes

3.1.2. Wall as a Spatial Component

In the Italian restaurant of the Mylome Resort Hotel, the walls feature two different but similarly textured concrete-look plaster in yellow and green colors. Gold-colored metal borders are observed at the junction point of these two plasters. One of the walls has blue-colored glass with black metal frames on the front part of the plasters, and the upper part consists of metal pipes, forming a wall covering that extends to the ceiling. In the Italian restaurant of the Seaden Quality Hotel, the walls are adorned with wood veneer, wallpaper, and distressed-looking wall panels. The wood veneer used has an oak-like appearance with semi-circular cuttings. The



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wallpaper is gray and has a linen texture. The distressed wall panel is a decorative panel based on styrofoam and features patterns reminiscent of the metal panels in front of stained-glass windows in Italian churches.

At the Diamond Deluxe Hotel's Italian restaurant, the walls display bricks, lacquered paneling, wood veneer, and marble with metal frames. The decorative bricks are white, and some sections feature silhouettes of Leonardo Da Vinci's self-portrait, a quote attributed to him, and the silhouette of the female figure from his artwork, the Mona Lisa. Gray lacquered panels have lacquered frames, and some parts of the walls resemble columns from the Ancient Greek era, created from lacquered paneling. Walnut veneer wainscoting strips are present at some points where the white brick and lacquered paneling meet. In niches within the gray lacquered panels, there are gold-colored metal-framed panels with white marble-like patterns, and within the white marble, there is an intricate gold border in a baklava pattern.

In the Italian restaurant of the Bella Resort Hotel, the walls feature decorative plaster, distressed wall panels, metal-framed glass panels, and artificial plants. Four different textures and colors of decorative plaster are used, with anthracite-colored concrete-textured smooth plaster being predominant. Some areas feature white textured aged-looking plaster, abstract-looking plaster with predominant white and green tones, and damaged texture plaster in green, gray, red, and blue. The distressed wall panel consists of anthracite and gold-colored tile-like panels. The metal-framed glass panel is made up of interconnected glass tiles with a baklava pattern in gold, linked by gold tube metals.

In the Italian restaurant of the Narcia Hotel, the walls are adorned with stone cladding, wall paint, and wood veneer panels. White stones are used for the stone cladding, with some areas featuring oak veneer panels with wood knots. The rest of the space has been dyed plain wall paint (Figure 6).

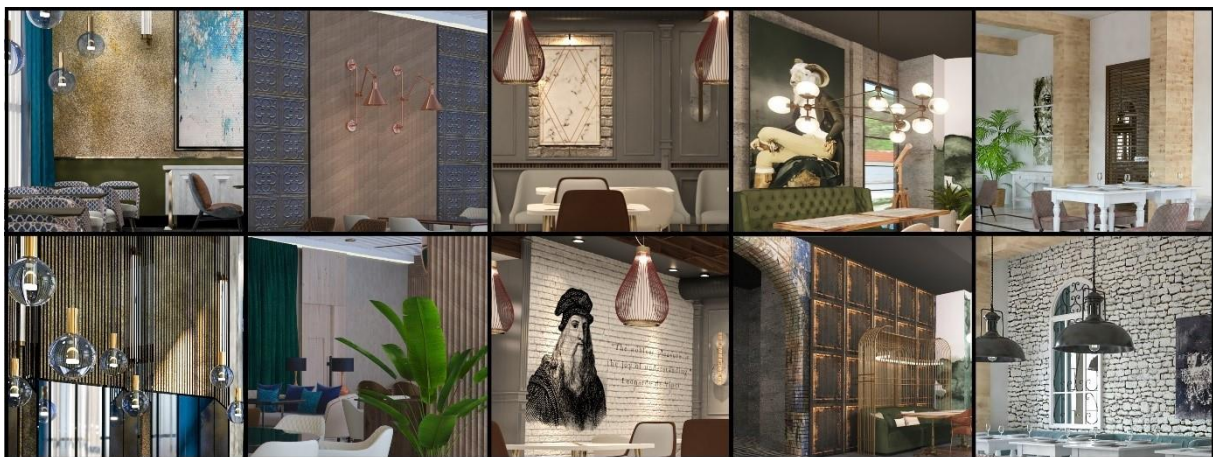


Figure 6. Walls From A'la Cartes

3.1.3. Column as a Spatial Component

In the Italian restaurant of the Mylome Resort Hotel, columns feature polyurethane cladding reminiscent of the Ancient Greek period, and the metal border that combines two different textured plaster colors on the walls also continues onto the column cladding. At the Seaden



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Quality Hotel's Italian restaurant, all columns are covered with half-moon cut oak veneer, and the baseboard sections are covered in black lacquer. In the Italian restaurant of the Diamond Deluxe Hotel, the columns continue the gray lacquered paneling with lacquered frames that is also used as wall cladding in some parts, resembling columns from the Ancient Greek era. In the Italian restaurant of the Bella Resort Hotel, the columns continue various decorative plasters used on the walls. In the Italian restaurant of the Narcia Hotel, the columns are adorned with oak veneer panels with wood knots, similar to the wall cladding used on the walls (Figure 7).



Figure 7. Columns From A'la Cartes

3.1.4. Column as a Spatial Component

In the Italian restaurant of the Mylome Resort Hotel, the beams continue the textured yellow plaster used on the walls. In the Italian restaurant of the Seaden Quality Hotel, beams are not visible, so nothing can be observed. In the Italian restaurant of the Diamond Deluxe Hotel, beams are not visible, so nothing can be observed. In the Italian restaurant of the Bella Resort Hotel, black wall paint is used on the beams. In the Italian restaurant of the Narcia Hotel, the beams continue horizontally as an extension of the oak veneer panels with wood knots, which also continue from the columns (Figure 8).

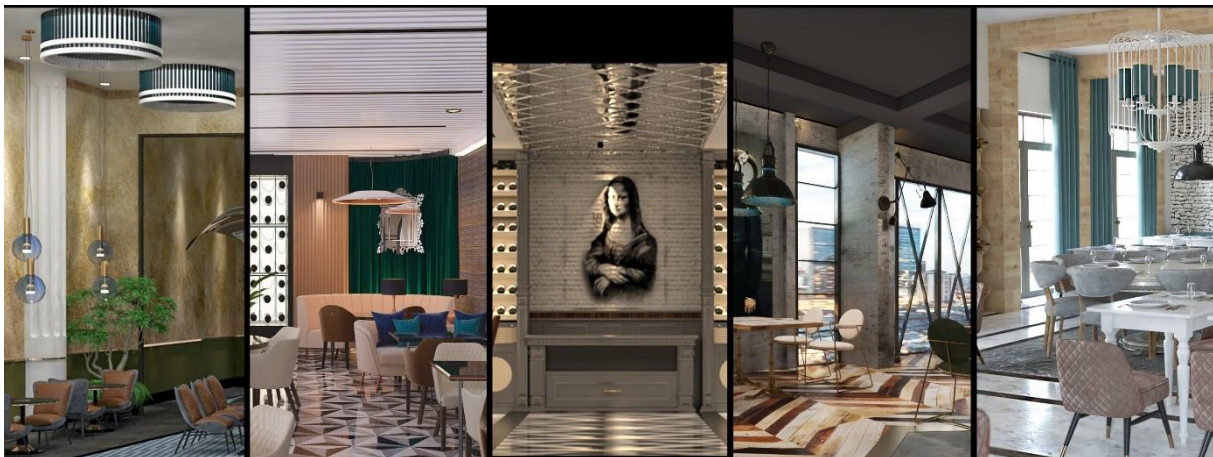


Figure 8. Beams From A'la Cartes



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3.1.5. Ceiling as a Spatial Component

In the Italian restaurant of the Mylome Resort Hotel, the ceiling features white concrete-textured plaster, and various types of lighting fixtures such as chandeliers, pendants, and spotlights are used. In the Italian restaurant of the Seaden Quality Hotel, the ceiling has wooden slats with intermittent white lacquered sections containing recessed spotlights in one part, while another part consists of anthracite-colored flat wooden lacquer panels with joints. In the Italian restaurant of the Diamond Deluxe Hotel, a portion of the ceiling with lower height is painted in white and anthracite, while the remaining section is covered with clear mirrors arranged in beveled tile-like pattern. At the junction where the high part of the ceiling meets the white ceiling paint, walnut veneer is used. In areas where the ceiling height is high, walnut veneer wood panels are observed. In the Italian restaurant of the Bella Resort Hotel, red brick cladding is used in the area where the ceiling is lowered, and the rest of the ceiling is painted in black. In the Italian restaurant of the Narcia Hotel, the entire ceiling is painted in white (Figure 9 and Figure 10).

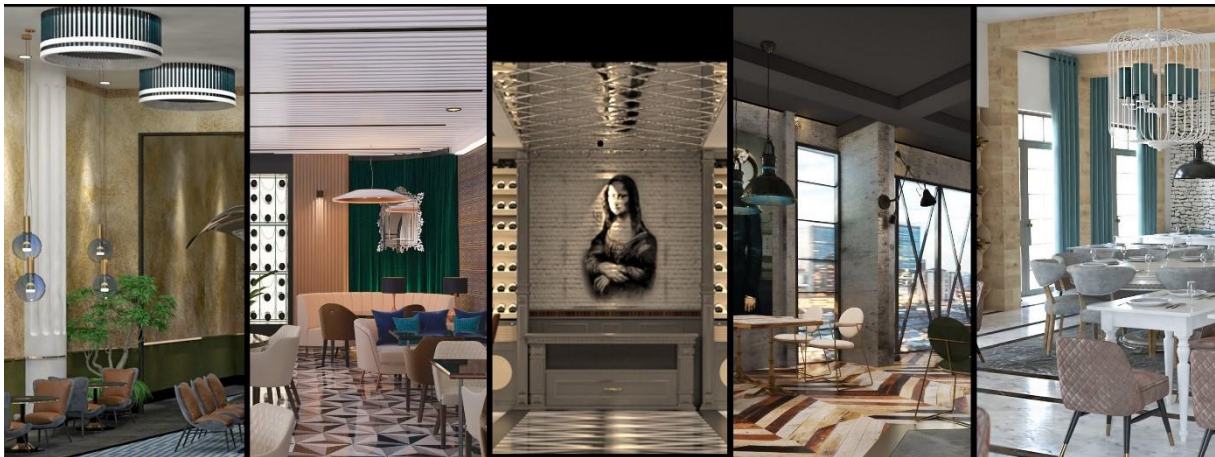


Figure 9. Ceilings From A'la Cartes

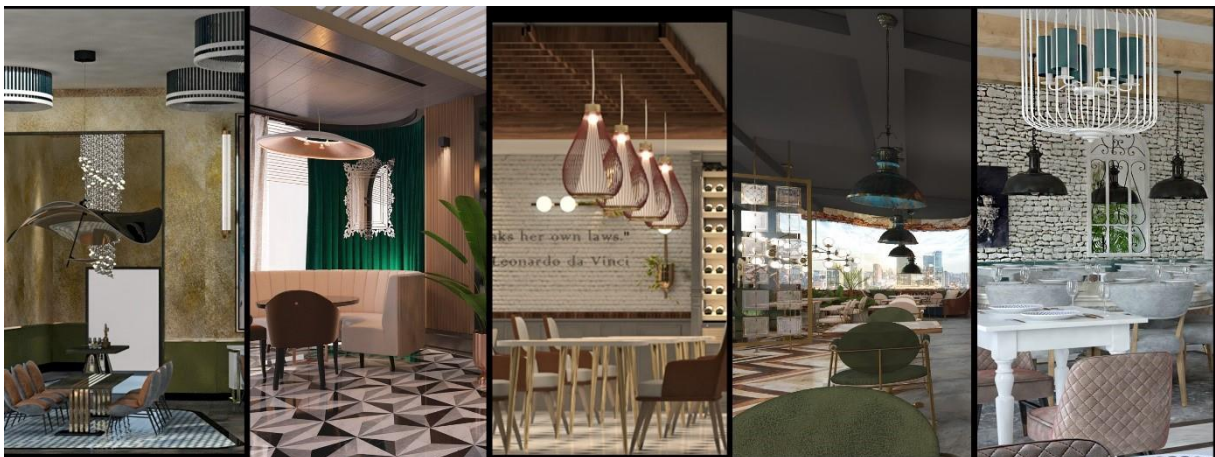


Figure 10. Ceilings From A'la Cartes

3.1.6. Door as a Spatial Component

In the Italian restaurant of the Mylome Resort Hotel, two types of doors are observed. The main entrance consists of a double-wing black aluminum-framed door, while the kitchen door is a white lacquered wooden door with a wooden frame and a gray metal kickplate at the bottom. In the Italian restaurant of the Seaden Quality Hotel, two types of doors are used. The main entrance features a double-wing black aluminum-framed glass door, while the kitchen door is made of oak veneer wood material, which is also used in the wall and column coverings. The door has oak veneer both on the frame and the wing sections, and it has a gray metal kickplate at the bottom. In the Italian restaurant of the Diamond Deluxe Hotel, two types of doors are observed. The main entrance consists of a double-wing black aluminum-framed glass door, while the kitchen door is made of gray lacquered material, which is also used in the wall coverings. The door has gray lacquer on both the frame and the wing sections, and it has a black metal kickplate at the bottom. In the Italian restaurant of the Bella Resort Hotel, a black aluminum-framed glass door is used, with horizontal black aluminum profiles. In the Italian restaurant of the Narcia Hotel, a double-wing gray aluminum-framed glass door is used, with a partition in the upper part made of vertical aluminum profiles and aluminum tiles (Figure 11).



Figure 11. Doors From A'la Cartes

3.1.7. Window as a Spatial Component

At Mylome Resort Hotel's Italian restaurant, black aluminum-framed glass windows with horizontal and vertical aluminum framing creating partitions are observed. In the Italian restaurant of Seaden Quality Hotel, there are arched black aluminum-framed glass windows with wooden sunshades in the arched section. In the three-dimensional works of the Italian restaurant of Diamond Deluxe Hotel, there is nothing observed related to windows. In the Italian restaurant of Bella Resort Hotel, three types of black aluminum-framed glass windows are observed. The first one is a glass window with horizontal aluminum profiles, similar to the door. The other two windows are in lattice patterns with aluminum framing, connected from end to end with diagonal aluminum profiles. In the Italian restaurant of Narcia Hotel, similar to the door, there are double-winged gray aluminum-framed glass windows with aluminum profiles dividing them, and aluminum-framed glass windows with cross-profiles in a lattice pattern (Figure 12).



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Figure 12. Windows From A'la Cartes

3.2. Spatial Elements

Spatial elements are defined as concepts that take their place in the space after the formation of the structural space.

3.2.1. Movable Furniture as a Spatial Element

Mylome Resort Hotel's Italian restaurant features 2 types of chairs, 1 type of bench, 1 type of sideboard, and 3 types of tables. The first chair has anthracite-colored lacquered legs, an exterior covered in anthracite textured leather fabric, and an interior covered in cinnamon-colored leather fabric. The second chair has a hexagonal patterned fabric in blue and white for the backrest, while the seat is covered in white and anthracite fabrics, and it has shiny metal-looking gray legs. The bench has seating and backrest parts made of the same leather fabric as the first chair, while its legs are made of anthracite-colored lacquer material. The sideboard has gold-colored metal legs covering most of the mass, with the cabinet and drawers covered in white lacquer. As for the tables, the first one has a black metal leg and a top table with an elegant gold metal frame surrounding a smoky glass surface. The other two table models have gold metal legs, with the tabletop of one being circular and the other being square, both made of gold metal and anthracite compact laminate material. Seaden Quality Hotel's Italian restaurant includes 3 types of chairs, 1 type of bench, 1 type of sideboard, and 3 types of tables. Two of the chairs share a brown leather fabric and black lacquer legs; one has a striped pattern on the backrest, while the other has a diamond-shaped pattern. The third chair has the same model as the brown patterned chair but features white leather fabric. The bench has vertical stripes on the backrest and is entirely covered in white fabric, with gold metal legs similar to the chairs. The sideboard is entirely made of walnut veneer wood, while all tables have gold metal legs, with tabletops made of black marble and gold metal frames. The tables vary in size and shape. Diamond Deluxe Hotel's Italian restaurant offers 2 types of chairs, 1 type of bench, 1 type of sideboard, and 1 type of table. The first chair has a black leather exterior, a white fabric interior, and gold metal legs. The second chair is entirely covered in white fabric, featuring gold metal legs similar to the first chair. The bench is completely covered in white fabric, with gold metal legs. The sideboard is gray lacquer, with black metal handles on the drawers. The table has a white marble top and gold metal legs. Bella Resort Hotel's Italian restaurant provides 3 types



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of chairs, 3 types of benches, and 2 types of tables. Two chair models share the same gold metal frame design, with one covered in white fabric and the other in green fabric. The third chair model has a bronze metal frame and is covered in brown leather fabric. The benches feature tufted backs and walnut legs, available in green, red, or white fabric. One table has a white marble top with a gold metal border and legs, while the other table has a brown solid wood top and gold metal legs. Narcia Hotel's Italian restaurant offers 2 types of chairs, 1 type of bench, 1 type of sideboard, and 2 types of tables. The first chair has a brown fabric with a baklava pattern and gold metal legs, while the second chair has a gray concrete-textured fabric with wooden legs. The bench has a turquoise fabric for both the seat and backrest, with oak veneer wooden legs. The sideboard is white lacquered with black metal handles. One table has white lacquered top in a square shape, and the other has a white lacquered hexagonal top with ethnic patterns on the front (Figure 13).



Figure 13. Movable Furniture From A'la Cartes

3.2.2. Accessory as a Spatial Element

Mylome Resort Hotel's Italian restaurant features a welcome desk adorned with a gray metal object composed of rings, two different forms of smoky-colored glass vases, and another vase in gold metal. On the walls, two identical abstract paintings with earthy tones, blue, and white colors are displayed. Seaden Quality Hotel's Italian restaurant includes a mirror known as the "Venice Mirror" with a green curtain and a console table featuring a bronze-framed mirror and a lamp with an anthracite-colored shade. In Diamond Deluxe Hotel's Italian restaurant, an accessory depicting a different interpretation of Leonardo Da Vinci's wing model is hung on a white brick wall. Bella Resort Hotel's Italian restaurant showcases accessories like Galileo Galilei's telescope and paintings combining the Renaissance-era male fashion of goats, which were commonly found in Italy's mountainous regions. In Narcia Hotel's Italian restaurant, accessories include a crystal chandelier-shaped painting on the wall and paintings of women blended with green plant textures. These accessories contribute to the unique ambiance and thematic elements of each restaurant (Figure 14).



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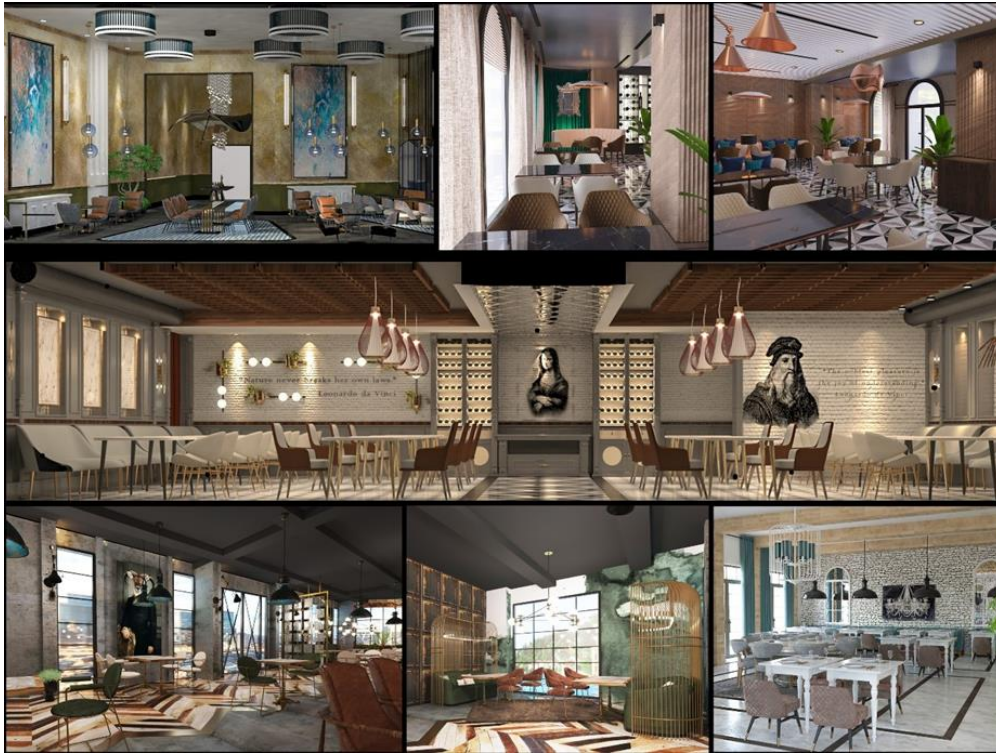


Figure 14. Accessories From A'la Cartes

4. CONCLUSION and RECOMMENDATIONS

The concept of authenticity in ethnic restaurants can vary depending on the cultural characteristics they aim to reflect. In the case of the first restaurant analyzed, Mylome Resort Hotel's Italian restaurant, it maintains a modern language while incorporating certain cultural references that define the authenticity of the space. Despite its modern approach, specific cultural cues within the restaurant contribute to its sense of authenticity. Similarly, the Italian restaurant in Seaden Quality Hotel, the second restaurant examined, shares similarities with Mylome Resort Hotel. This modern restaurant also incorporates elements like metal wrought-iron-textured wooden panels resembling Italian church architecture and the use of an iconic accessory like the "Venice Mirror" to convey authenticity. In contrast, the Italian restaurant within Diamond Deluxe Hotel, the third restaurant reviewed, distinguishes itself from the first two. In this space, where colors and material diversity are relatively sparse, elements like lake-coated panels resembling Ancient Greek columns and drawings related to Leonardo Da Vinci and his works on white bricks contribute to the perception of authenticity. Bella Resort Hotel's Italian restaurant, the fourth restaurant analyzed, stands out as the most diverse in terms of color, texture, and accessory variety, despite having modern lines. The fusion of the goat, commonly found in Italy's mountainous regions, with Renaissance-era male fashion on canvas, along with elements like black bricks on the ceiling and earth-toned ceramics on the floor, enhances the sense of authenticity. The Italian restaurant within Narcia Hotel, the fifth restaurant examined, appears fundamentally different from all the others. While it incorporates modern elements, the overall design emphasizes an ethnic feel through its texture and colors. However, the complete detachment from contemporary design trends raises questions about



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whether the space might be overly commodified. The term "authentic" implies adherence to local or original characteristics, and while many restaurants aim to capture this essence, the study reveals that each restaurant incorporates authentic elements in its own way. It is important to note that the pursuit of authenticity in restaurants can sometimes lead to commercialization, even though the intention may be to create authentic dining experiences.

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POST-COVID-19 WITH A RETROSPECTIVE APPROACH: RESTAURANT SPACES IN TÜRKİYE

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ABSTRACT

Despite the fact that the covid-19 period ended with taken measures, it was referred as the "new normal" period because of the awareness and habits it created. Among the sectors most affected during the pandemic, restaurants were the establishments that experienced the most significant changes. In the scope of this study, concepts from the literature before the Covid-19 period were investigated to determine important parameters for restaurant designs. New parameters and user expectations that were introduced during the pandemic and either permanently or temporarily observed, depending on the continuity of the measures taken, were evaluated. A retrospective approach was employed to systematically present the process that restaurants underwent after the first Covid-19 case in Turkey. It was found that concepts such as social distancing, contact reduction, and hygiene, which were frequently mentioned during the pandemic, influenced the spatial layout of restaurants. Given the importance of hygiene, which has become an expectation due to new habits brought about by the pandemic, and the increased emphasis on natural ventilation, there is a need to increase the use of open and semi-open spaces. However, the concept of social distancing was not as crucial during the post-pandemic period and did not persist as a permanent habit. The proliferation of contactless transformations in restaurants, such as cloud kitchens, was also observed. In conclusion, the parameters from the pre-pandemic period and the new concepts that emerged were evaluated together. Recommendations were provided regarding the criteria that should be considered in restaurant designs during the post-pandemic 'new normal' period.

Keywords: Post Covid-19, New Normal, Restaurant.

1. INTRODUCTION

The Covid-19 (SARS-CoV-2) virus, which leads to Severe Acute Respiratory Syndrome, was recognized as a global pandemic with a confirmed case count exceeding 600 million (Dong, Du, Gardner 2020). Following the declaration of a pandemic by the World Health Organization (WHO), many governments implemented significant mobility restrictions (isolation, social distancing, travel bans, quarantine, etc.) in order to prevent the comprehensive and rapid spread of the disease, which had a significant impact on the global economy (Nicola et al. 2020). As a result of all these measures, restaurants suffered from a decrease in consumer traffic (Sedov 2022). During the period of curfews, mandatory mask usage, restrictions on intercity travel, and social distancing measures, there were changes in individuals' attitudes and behaviors.



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According to Karataş (2020), in Turkey while there has been an average increase of 85-90% in behaviors involving protective measures such as cleaning, hygiene, and the use of masks and gloves due to the Covid-19 pandemic, there also has been a 95% reduction in being in crowded places. Crowding is a crucial factor in consumers evaluating a restaurant's popularity (Tse et al., 2002). However, during the pandemic, crowding is far from the concept of a safe restaurant environment. When restaurants reopened after mandatory closures, they had to implement social distancing measures to ensure the safety of both employees and customers. In order to mitigate the negative effects of the pandemic, various research studies developed implementable solutions. Some of these solutions were mandated by the government, while others were strategies devised by restaurant owners to sustain their businesses. However, it was uncertain how consumers would react to these measures. According to one study, consumers showed different likelihoods of visiting restaurants that placed partitions between tables compared to those that created separate dining room sections. Additionally, the preferences of different age groups varied depending on the measures taken (Taylor Jr., 2020). In the "new normal" introduced into our lives after the pandemic, some of the measures taken have become a part of our lives temporarily, while others are permanently. Looking back, the measures taken and the parameters that need to be evaluated in restaurant settings going forward were discussed within the scope of this study.

2. Temporal Analysis of Measures Taken in Türkiye During the Covid-19 Period

The first Covid-19 case in Turkey was confirmed on March 11, 2020 (Republic of Turkey Ministry of Health, 2020). The initial measure taken by the Ministry was the temporary suspension of primary and secondary education for one week, and tertiary education for three weeks, starting on March 12th. Subsequently, establishments such as bars, nightclubs, theaters, cinemas, and other entertainment venues were temporarily closed. The escalation of preventive measures commenced following the first Covid-19-related fatality on March 17, 2020. The Ministry of Interior, issued a circular mandating that all dining establishments, whether serving alcoholic beverages or not, were to exclusively provide takeout and delivery services, with no permission for on-site dining, on March 21, 2020. The "Stay at Home" campaign was initiated to minimize interpersonal interactions, with the objective of curtailing the transmission rate. For the duration of the pandemic, vulnerable demographic groups such as individuals aged 65 and older and those with chronic health conditions were subjected to restricted outdoor mobility as a precautionary and preventive measure. As of April 4th, individuals under the age of 20 were also encompassed by these restrictions. This period persisted until May 10, 2020, following which specific hours of freedom were granted, contingent upon adherence to designated distancing measures, such as only visiting locations within walking distance from one's residence. In April, international travel restrictions were universally introduced to manage the impact of the Covid-19 pandemic on public health and to effectively govern the rate of contagion. In Turkey, these restrictions were enforced on an intercity level, commencing from April 3, 2020.

As of May 17, 2020, with the commencement of a phased normalization process, the Ministry of Health, the Ministry of Agriculture and Forestry, and other relevant institutions and organizations in Turkey issued circulars and general principles in line with the recommendations of the Centers for Disease Control and Prevention (CDC) to prevent the spread of the disease. Guidelines were established emphasizing the importance of people staying away from enclosed spaces as much as possible. However, when it was necessary for



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individuals to gather in such spaces, guidelines were provided regarding mask usage, social distancing measures, and hygiene precautions (URL-1).

As a result of these measures, cafes, restaurants, sports facilities, parks, and other places were gradually reopened with time limitations and specific usage rules. Restrictions on intercity travel were also lifted. On June 10, 2020, restrictions for individuals under the age of 18 and those aged 65 and above were eased. The operating hours of restaurants, cafes, and similar establishments were extended. After five months of gradually easing measures and restrictions, it was announced on November 17 that education would continue remotely, weekend curfews would be imposed for all age groups with hourly limitations on outings, restaurants would only provide takeout services, and shopping centers would operate during specified hours (url-2).

On January 13, 2021, the first coronavirus vaccine arrived in Turkey and received emergency use approval, administered to the Minister of Health, Fahrettin Koca (URL-2). According to data from the Ministry of Health, the rate of first-dose vaccination in Turkey was determined to be 93.36%. With the widespread vaccination effort and following a two-week partial lockdown imposed on April 14, followed by a full lockdown, Turkey began to return to normal life on July 1, 2021. After approximately a year, on March 2, 2022, the mandatory mask usage requirement in public transportation was lifted, marking the conclusion of pandemic precautions (Table 1).

Table 1. Turkey's COVID-19 pandemic timeline

1	The first Covid-19 case detected in Türkiye	March 11, 2020
2	Suspension of primary and secondary education for one week, and tertiary education for three weeks	March 12, 2020
3	Closure of bars, nightclubs, theaters, cinemas, sports facilities, and other entertainment venues	March 15, 2020
4	First Covid-19-related death reported, cessation of mutual flights with the UK, Switzerland, Ireland, Saudi Arabia, the United Arab Emirates, and Egypt	March 17, 2020
5	Curfew imposed for citizens aged 65 and above, initiation of the "Stay at Home" campaign, and decision for restaurants to provide only takeout services	March 21, 2020
6	Ban on entry and exit for 15 days to 30 metropolitan cities and Zonguldak	April 3, 2020
7	Curfew for individuals under the age of 20	April 4, 2020
8	Weekend curfew implemented for the first time (30 metropolitan cities and Zonguldak)	April 11-12, 2020
9	Official holidays combined with weekends, resulting in a total of 4 days of curfew	April 23, 2020
10	Announcement of the normalization calendar by the Presidency	May 4, 2020
11	Commencement of phased normalization	May 17, 2020



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12	Reopening of venues such as cafes, restaurants, coffeehouses, sports facilities, swimming pools, thermal baths, and parks with specific rules and time limitations, as well as the lifting of intercity travel restrictions	June 1, 2020
13	Easing of curfews for individuals aged 18 and under and those aged 65 and above, and extension of operating hours for restaurants, cafes, and coffeehouses	June 10, 2020
14	President announced that education would continue remotely, weekend curfews would be imposed from 10:00 AM to 8:00 PM, restaurants would provide only takeout service, and shopping malls and markets would close at 8:00 PM	November 17, 2020
15	First Covid-19 vaccine administered	January 13, 2021
16	Implementation of a 2-week partial lockdown	April 14, 2021
17	Full lockdown	April 29 to May 17
18	Return to normal life	July 1, 2021
19	Mandatory mask usage lifted	March 2, 2022

In the process marked by quarantine decisions, curfews, travel bans, and stay-at-home campaigns, the food and beverage sector emerged as one of the hardest-hit industries. Restaurants (Goddard, 2020), faced with issues such as workforce losses due to employee illness, disruptions in supply chains, a decrease in customers due to pandemic concerns, and the consequent inability to achieve sufficient sales, had to adjust in their current operations (Kocaman et al., 2021). Some of these adjustments were mandated by government ministries as compulsory measures, while others were implemented as strategic methods and ideas adapted by restaurants in their efforts to survive.

2.1. Mandatory Measures Taken in Restaurants

According to the Ministry of Health guidelines, following the commencement of customer acceptance by food and beverage establishments with the gradual normalization directive as of May 17, 2020, a series of mandatory measures were mandated. Establishment operators, as outlined in the directive sent to all 81 provinces (url-3), are obligated to adhere to these rules/practices throughout the entire facility. One of the necessary measures is the preparation of a social distancing plan regarding widespread use areas and seating arrangements. Restaurants have determined their customer capacity based on this plan, and this capacity information is displayed in a visible location at the facility's entrance. Additionally, panels containing the measures implemented in the facility and the precautions that must be followed have been arranged in widespread use areas easily visible in the facility's entrance hall or exterior facade (Figure 1).

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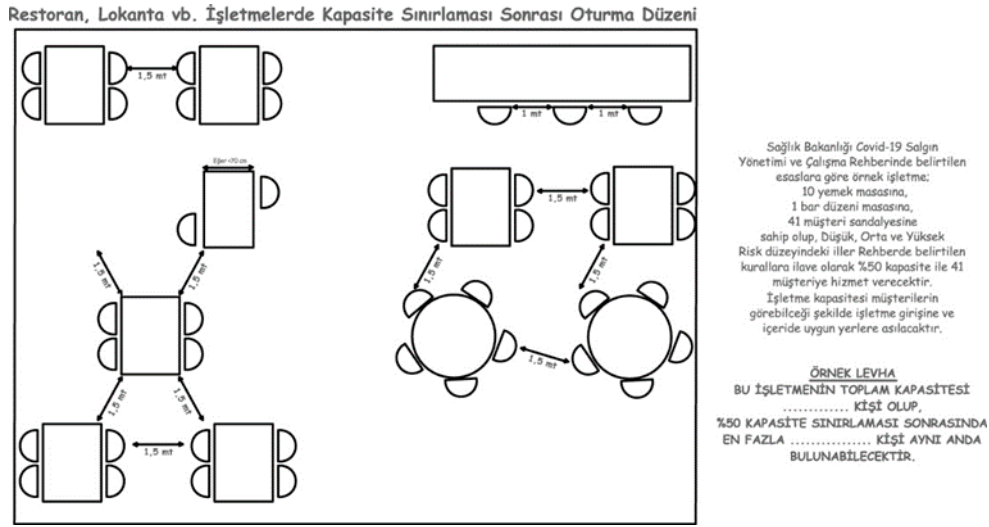


Figure 1. Seating arrangement after capacity limitations

Customer entry into the establishment involves the use of a thermal camera or contactless temperature measurement. Customers with a temperature measurement exceeding 38 degrees Celsius are not allowed into the restaurant and are advised to seek medical attention. Furthermore, hand sanitizers or cologne are provided at entrances to ensure customers' hand hygiene before entering. Customers without masks are not accepted, and if they do not have masks, restaurants provide masks.

Within the restaurants, dining areas, entrance areas/lobbies, additional rooms, restrooms, any designated smoking areas, and open spaces, including the entire facility, have been arranged in compliance with the social distancing plan. Social distancing signs have been placed both for seating arrangements and in areas where queues may form to maintain the required distance.

The seating arrangement of tables and chairs has been rearranged according to distance rules. The distance between tables is set at 1.5 meters, and the distance between chairs placed side by side is 60 centimeters. When tables need to be combined for larger groups, the distance requirement is maintained without compromise. Placing chairs at the same table or a crowded seating arrangement is not allowed. In tables with a narrow side less than 70 cm wide, a diagonal seating arrangement is applied to increase the distance between customers sitting across from each other. In bar table arrangements where customers sit side by side, the distance requirement is set at 1 meter. The use of tables where staff and customers face each other directly is prohibited.

If there is a buffet service in the restaurant, plexiglass or similar barriers have been placed between the buffet and customers to protect against contact. Similarly, devices such as tea and coffee machines, water dispensers, and beverage dispensers have been removed to minimize person-to-person contact, and their service is now provided by staff.

Cleaning and disinfection after each use is required for dining tables, chairs, and all materials that customers may come into contact with (tableware, salt and pepper shakers, condiment containers, napkin holders, menus, etc.). It is preferred that items for shared use, such as salt and pepper shakers, and condiment containers, be provided as single-use items if possible. One of the items requiring disinfection after each use is the payment device. It is recommended to



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sterilize it with a cleaner containing at least 70% alcohol, and contactless payment methods are preferred when possible.

In addition to providing hand sanitizers at the entrances to public restrooms in restaurants, it is recommended that entrance doors be replaced with automatic door systems if possible. If not, it is mandatory to ensure the continuous cleanliness of entrance doors. Floors, toilet bowls, urinals, sinks, and faucet handles must be cleaned with bleach. Furthermore, in restrooms, hand dryers have been disabled, and single-use paper towels have been introduced.

Indoor children's play areas in restaurants have been closed. Outdoor areas have been left open, provided that they are cleaned frequently, but the presence of small materials and toys that cannot be continuously cleaned has been prohibited. Materials that could involve extensive hand contact, such as game pieces and cards, have been prohibited due to the elevated risk of transmission (Ministry of Health, 2020).

2.2. Non-Mandatory Measures Taken in Restaurants

During the Covid-19 pandemic, in addition to the mandatory measures implemented by the government, restaurants took their measures to cope with the pandemic and adapt to it (Alonso et al., 2020). Many studies suggest that these methods developed to minimize the crisis's impact may become a standard part of the industry in the post-pandemic era (Kim et al., 2020; Lane, 2020; Breier et al., 2021). Indeed, many technological transformations implemented by restaurants during the pandemic may continue beyond it. One such example is contactless payment methods. Due to concerns that cash could be a source of transmission during the pandemic, the use of digital money, mobile wallets, and contactless cards for touchless payments rapidly became widespread. Additionally, digital menus, often accessed via QR codes placed on dining tables or placemats, gained popularity (Özen & Akpınar, 2022). Beyond QR codes, interactive restaurant tables, which offer not only digital menus but also order recommendations, allow customers to place orders without assistance and even watch their orders being prepared in the kitchen. However, this system has not been widely adopted due to its cost and the high likelihood of accidents like liquid spills (Echtler & Wimmer, 2013; Tursan, 2021). Another technology used without the need for staff is self-service kiosks for ordering and payment. These kiosks are easy to clean and offer contactless options such as biometric recognition and voice ordering, making them increasingly popular (Özen & Akpınar, 2022).

In the context of contactless dining options, cloud kitchens have gained significant attention during the Covid-19 pandemic. Also known as dark kitchens or ghost kitchens, cloud kitchens have become a trend (Kulshreshtha & Sharma, 2022). These kitchens are specialized in food delivery and lack physical dine-in areas or storefronts. Some cloud kitchens are shared and rented by multiple restaurants (Hakim et al., 2022). These establishments do not have a physical dining area to host customers; orders are placed online, and deliveries are made through takeout or delivery services. The pandemic accelerated the growth of this concept due to restaurant closures and safety concerns (Ruiying Cai et al., 2021).

Customer safety concerns have also influenced consumers' restaurant selection criteria. For example, research suggests that private dining rooms in restaurants have been preferred because they make customers feel safer (Güngör, 2020; Tse et al., 2020). Many restaurants have made customizations in response to this trend, such as partitioning dining areas with glass or plastic materials to prevent contact with other customers. Similarly, temporary measures have been



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taken with materials like plexiglass to reduce contact between customers. These barriers can divide spaces between tables and, in some cases, even separate individuals at the same table, creating isolated environments.

According to studies measuring customer behavior through survey-based methodologies (Ziberzani et al., 2022; Siddiqi et al., 2022; Kastromitina et al., 2021), the hygiene measures implemented by restaurants during the Covid-19 pandemic have changed behavioral responses. Brandau (2020) found that regularly and visibly cleaning tables, kiosks, and other touched surfaces, as well as employees wearing food safety-appropriate attire, were among the most effective ways to make restaurant customers feel safe. Some restaurants have also improved their hygiene measures to strengthen the relationship between hygiene and trust. In addition to adhering to the recommendations of the Centers for Disease Control and Prevention (CDC) and the Health Ministry's working guide, measures such as improving the ventilation system, using antibacterial materials, and implementing touchless doors and faucets have been taken to enhance hygiene and customer confidence.

3. METHOD

In the study, spatial concepts influencing restaurant choices in the post-Covid-19 'new normal' life were examined. The universe of the research consists of parameters related to space. A "purposive sampling" method was used for sampling. According to this method, suitable groups, factors, units, etc., are determined in accordance with the purpose of the research (Büyüköztürk et al., 2011). The sampling process was conducted in three stages. In the first stage, to determine the parameters affecting the space before the Covid-19 period, the main keyword "restaurant" was used to search Google Scholar, WOS, Science Direct, and DergiPark. Then, studies focusing on the space for restaurants were filtered, and suitable studies were selected based on accessibility, scope, and research purpose criteria. In the final stage, prominent concepts related to restaurants were identified using the keywords "Covid-19; restaurant".

Additionally, a retrospective approach was applied in the research. The term "retrospective" comes from the French word "rétrospective," which means "from the past to the present" (TDK). In the Cambridge dictionary, the retrospective is translated as "related to or thinking about the past" in general terms. In scientific research, it has been used as a method in many fields. In the medical field, this concept is used as a data collection technique. If groups of patients with common characteristics are examined retrospectively towards the past, a retrospective study is conducted. Researchers collect retrospective information to investigate cause-and-effect relationships (Çaparlar & Dönmez, 2016). Retrospective diagnosis is the process of determining a disease after the patient's death. This also includes interpreting unknown causes of death in history or ambiguous diseases in society as contemporary events (Burnham, 2005). The retrospective method is an evaluation of what has been done before in software development. It questions what went well, what did not, how it can be improved, what did not work, or what will be done differently next time (Jovanovic, 2016). In the field of art, it is a method that presents the past works of an artist with details such as the artist's stages, periods, changes in style, etc. (Ayan, 2013).

In summary, the retrospective method, applied in various fields with different perspectives, has been used in this study to provide a systematic view from the past to the new normal. It observed the sustainability of criteria that entered our lives during the pandemic in restaurant spaces



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before the pandemic. In the period before Covid-19, the literature related to restaurants was associated with concepts such as ambiance, spatial layout and functionality, flexibility, signs and symbols, facility aesthetics, materials, and services. During the Covid-19 period, concepts of social distancing, hygiene, and contact were added (Figure 2), and their relationships were evaluated with a retrospective approach.

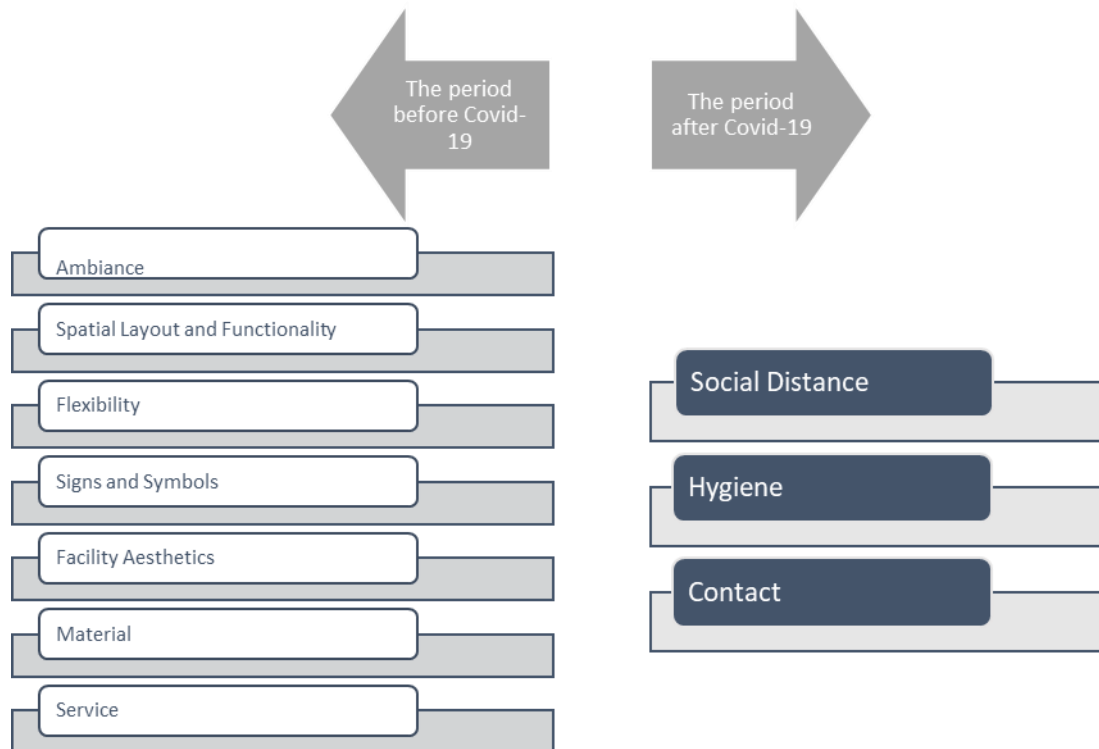


Figure 2. Prominent concepts in restaurants before and after Covid-19

The addressed concepts pertain to restaurant architecture, spatial arrangements within restaurants, spatial narratives, interior design, decoration, and criteria influencing design decisions. The explanations of these headings, their contents, and references are presented in the "Findings" section.

4. FINDINGS

The extended duration and widespread impact of the Covid-19 pandemic, posing a significant threat to public health, led to the implementation of quarantine measures, travel restrictions, and various regulatory policies by governments worldwide. These measures resulted in significant changes in the services and establishments, not limited to Türkiye but on a global scale, particularly within the restaurant industry. When scrutinizing the chronological aspects of the Covid-19 measures enforced in Türkiye, which encompassed restrictions affecting restaurants, it is discerned (Figure 3) that from March 21st until June 1st, only takeout services were authorized. It was only after the widespread distribution of vaccines and the commencement of the "new normal" phase that restaurants resumed their operations, albeit with specific regulations and constraints in place.



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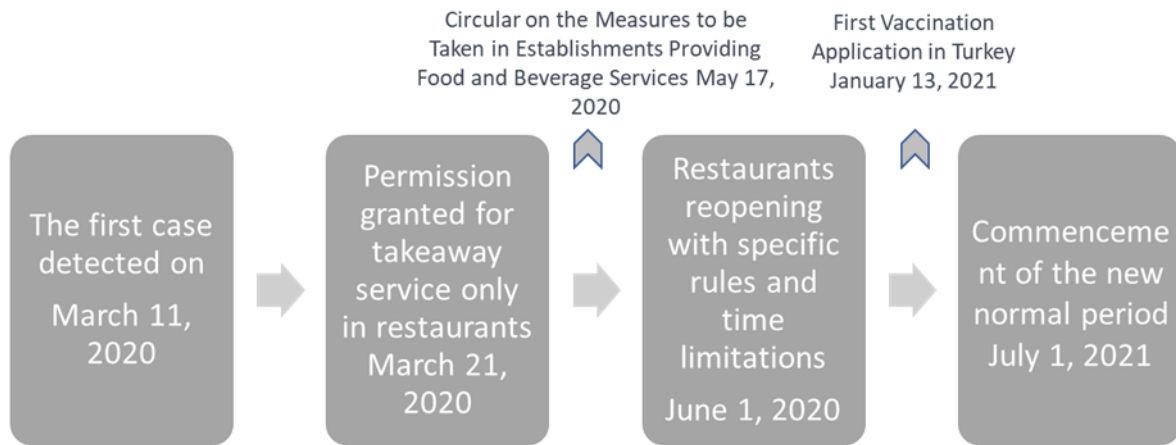


Figure 3. Restaurant process during the Covid-19 Period

When conducting a literature review, seven main headings related to restaurant spatial parameters that existed before the Covid-19 period have been identified. These headings are ambiance (Bitner, 1992; Ryu, 2005; Waxman, 2006, etc.), spatial layout and functionality (Bitner, 1992; Ryu 2005, etc.), flexibility (Oxman, 1975; Yürekli, 1983; Forty, 2000, etc.), signage and symbols (Bitner, 1992, etc.), facility aesthetics (Wakefield and Blodgett 1999, Ryu 2005, etc.), materials (Bitner, 1992; Galip & Gültekin 2015, etc.), and the service provided (Fathy, 1992; Ryu, 2005, etc.).

Ambiance refers to the background characteristics that tend to influence the environment. These characteristics can have abstract sensory and subconscious effects (Ryu, 2005). These background conditions include temperature, air quality, lighting, noise, music, and scent (Baker, 1987; Bitner, 1992). During the Covid-19 period, natural ventilation became crucial in this parameter. Indoor spaces were frequently ventilated naturally by opening doors and windows, and if air conditioning was used, proper maintenance and sterilization were necessary measures.

Spatial Layout and Functionality encompass the arrangement methods of furniture and equipment, which include their size, shape, and relationships between them. This arrangement should align with the needs of the service delivery process (Bitner, 1992). As of June 1, 2020, the reopening of dining establishments adhered to specific rules, with social distancing measures playing a crucial role in spatial organization. Distances between tables and customers were pivotal in establishing the spatial layout. The Ministry of Health defined suitable distances between tables, chairs, and bar setups and imposed seating capacity limits. Measures were taken to ensure That there was no direct face-to-face contact between service personnel and customers in bar setups (Figure 4).

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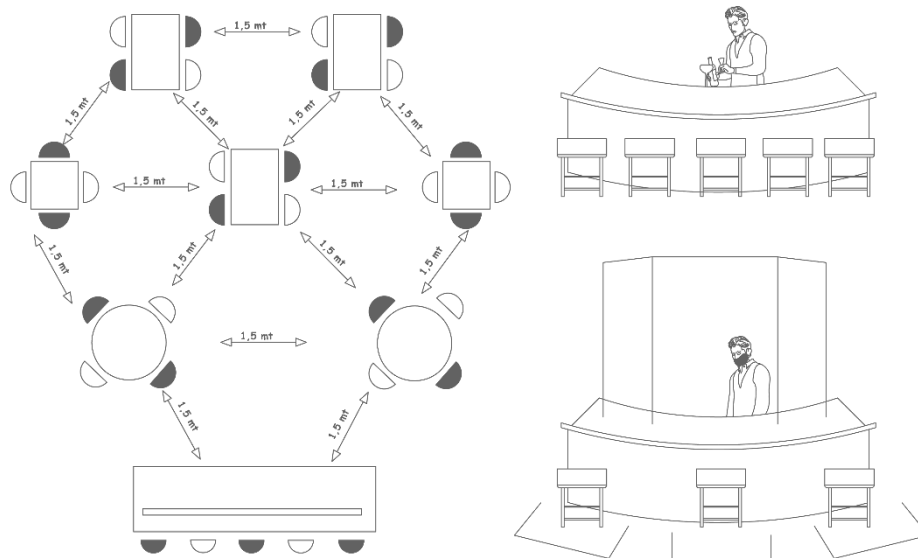


Figure 4. Restaurant seating and bar arrangement

As part of non-mandatory measures, the creation of private seating areas by completely separating each table from each other aimed to establish a sense of safety in restaurants by creating isolated spaces. These measures were mostly observed in the outdoor areas of restaurants in Türkiye (Figure 5). Seating areas created in the form of private rooms using transparent materials continued to be used even after the pandemic due to their ability to provide protection in various weather conditions such as rain or snow and their appeal as a unique space.

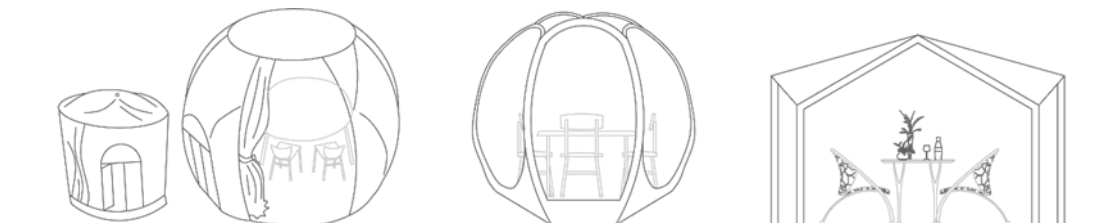


Figure 5. Private dining rooms

Flexibility is a concept that establishes a dynamic relationship between the environment, technology, function, and alternative designs or multipurpose use according to changing conditions (İslamoğlu & Usta, 2018). During the Covid-19 period, in addition to mandatory social distancing rules, restaurants experimented with alternatives to minimize the risk of transmission by implementing flexible structures that could be assembled and disassembled according to their own preferences. In this context, separators created using transparent materials such as plexiglass and glass were frequently preferred. These separators could separate two tables or serve as a protective measure for individuals sharing the same table (Figure 6).

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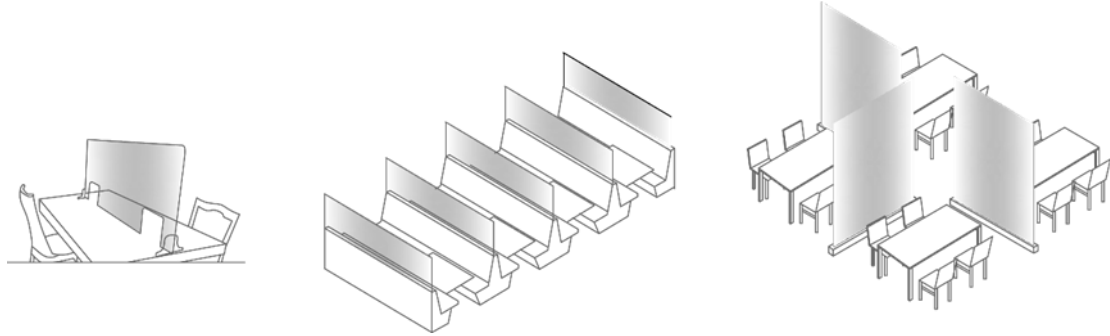


Figure 6. The separators used to prevent transmission

Signs and symbols include directional signs displayed inside or outside the facility, warning signs containing behavioral rules, and promotional signs and symbols of the facility's brand (name, logo, etc.). Social distancing signs were expected not only in the dining area but also in all areas of the restaurant (elevator, restrooms, payment counter, etc.). Both restaurant staff and customers were expected to adhere to the distance that varies between 1.5 to 2 meters (Figure 7).



Figure 7. Social distancing signs

Facility aesthetics refers to architectural design, interior design, and decorative elements that contribute to the attractiveness of the physical environment. In restaurants, it is considered a marketing tool that can influence consumer attitudes, price and value perceptions, satisfaction, and behaviors (Ryu & Han, 2009). During the pandemic, restaurants offered creative ideas to make pandemic measures aesthetically pleasing. Open kitchen designs, stylish dividers, and socially distanced custom-designed rooms, which allowed customers to witness safety and hygiene rules, continued to be preferred mostly in luxury restaurants during the pandemic era.

The characteristics of the materials used and their relationship with other materials affect the effectiveness and enhancement of the space (Erçetin & Erdemir 2021). During the pandemic,

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with the increased emphasis on hygiene, restaurants turned to the use of antibacterial and antiviral materials.

The services offered encompass the typology of the service to be provided and include services such as parking, children's play areas, and others. The formation of a fast-food establishment would not be the same as that of a luxury venue. Similarly, services to be offered such as buffet usage, parking facilities, and children's play areas, will affect the formation of the venue. During the Covid-19 pandemic, restaurants faced significant restrictions on their service standards. To reduce contact rates, the use of open buffets was suspended, and service was provided by service staff. In addition, to the use of shared items such as tea and coffee machines, and water coolers, service staff also managed beverage dispensers. Service personnel are required to wear masks. Some restaurants have also implemented protective barriers between staff and customers (Figure 8).



Figure 8. Service from staff rather than self-service at the open buffet

Similarly, the preventive measures imposed have led to the prohibition of children's play areas and gaming services provided by restaurants in order to prevent transmission through contact (Figure 9). With the lifting of these measures, these services have not been observed to become a part of the new normal in Türkiye.

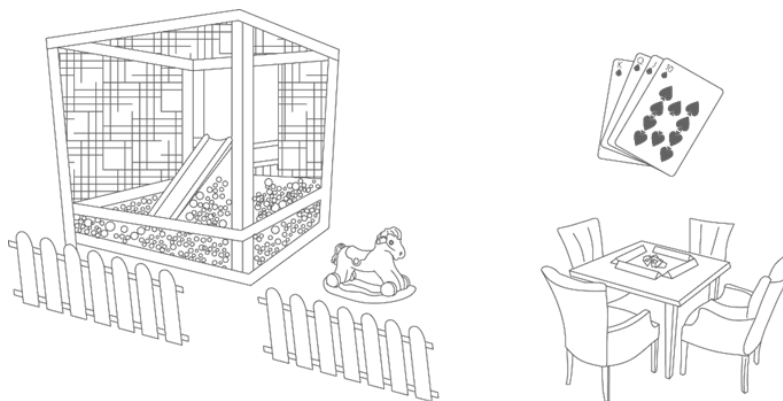


Figure 9. Prohibitions on games

Non-mandatory measures in the scope of restaurants have led to technological transformations. Contactless payment methods, the use of QR codes in menus, and contactless kiosks have become widespread. Contactless transactions or the continuous cleaning of touched surfaces have become standard expectations for customers (Figure 10).



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Figure 10. Cleaning after each use

In the context of non-mandatory measures, restaurants have transitioned to using single-use paper towels instead of electric hand dryers in restrooms. However, this practice has been phased out in the new normal. Maintaining cleanliness in restrooms and regular cleaning remains an important criterion for space quality in the new normal. Additionally, in non-mandatory measures, restaurants continue to use transformed elements such as automatic sensor doors and sensor faucets. However, measures like providing hand sanitizers and cologne are no longer observed in the new normal (Figure 11).

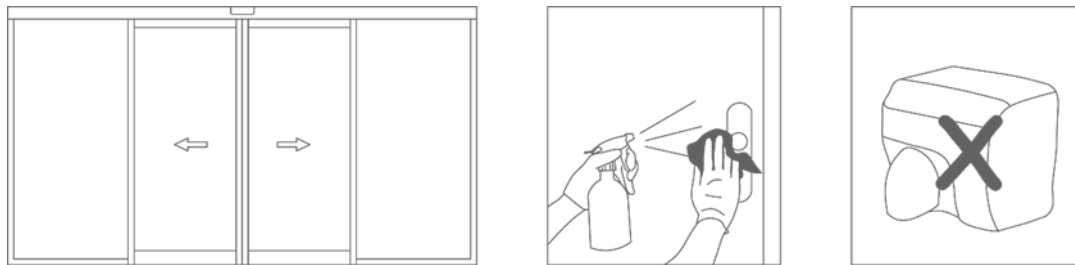


Figure 11. Precautions were taken in restaurant restrooms during the Covid-19 period.

5. CONCLUSION and RECOMMENDATIONS

The Covid-19 pandemic had a profound impact on people's lifestyles, including their dining habits. As a result, changes occurred in food and beverage establishments. Prior to the pandemic, factors like ambiance, aesthetics, and functionality were highly regarded. However, during the pandemic, people became more concerned about their health. In response to this shift in consumer priorities, restaurants not only implemented mandatory measures but also took extra care to meet customer needs through strategies such as spatial reconfigurations, contactless features, and enhanced hygiene conditions.

These measures, whether consciously or unconsciously, raised awareness about the importance of concepts like "social distancing," "hygiene," and "contact." Bridges & Mitchell (2000) interpreted this increased awareness as consumers adapting to the new circumstances. When environmental changes occur, users tend to develop new habits, and these habits often persist. During the Covid-19 period, users indeed developed new habits and awareness (Gössling et al. 2021; Seth, 2020).

In this context, air quality became more critical than ever in creating the ambiance in restaurants in the new normal. Designs should facilitate natural ventilation in restaurants, and the necessity of open and semi-open spaces should be considered. Additionally, flexible spatial solutions that can adapt to changing conditions should be seen as essential spatial criteria. During the Covid-



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19 pandemic, the increasing popularity of cloud kitchens and delivery services had an impact on the spatial organization of restaurants. Likewise, the growing emphasis on food safety and hygiene expectations led to the proliferation of open kitchen designs. In this context, restaurants should be open to innovative ideas when it comes to their spatial configuration and the services they offer. Restaurants underwent significant technological transformations during this period, with the adoption of practices like QR code menus, contactless payments, ordering systems, sensor-operated doors, faucets, and more. These technological advancements are sustainable features that can be continued in the new normal. The use of antibacterial and antiviral materials also became widespread during the pandemic, emphasizing the importance of material selection in restaurants. It is crucial for restaurants to evaluate their material choices not only for aesthetic purposes but also with a focus on hygiene, considering the heightened importance of this concept during the Covid-19 period.

In the new normal, as daily routines and habits have changed, there is a greater need for open and semi-open spaces that provide adequate ventilation solutions, flexible spatial configurations to adapt to changing conditions, and innovative ideas driven by technological advancements. Although the emphasis on social distancing may have diminished as restrictions eased, it is important to note that isolated spaces created for this purpose should contribute to the ambiance and concept of the restaurant or provide protection against weather conditions like rain or snow. Restaurants should consider these concepts as integral parameters in their spatial design. With the increasing availability of vaccines and the return to a new normal, it is crucial for restaurants to acknowledge that even though restrictions may have eased, customer awareness and habits have changed. Therefore, spatial changes and adaptations remain essential in response to these evolving dynamics.

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**INTEGRATED DESIGN APPROACH IN NATURE-ARCHITECTURE
RELATIONSHIP**

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ABSTRACT

The discipline of architecture represents the relationship between nature, humans and the built environment. As the effects of being intertwined with nature on human psychology and physiology have been realized, research on this relationship has increased and gained importance. In recent years, there have been disconnects in the relationship between nature and architecture due to factors such as the development of technology, the increase in urban density, and the dominant approaches in the design of the built environment. Building biology and the biophilic concept are solutions for the sustainability of this relationship. Criteria such as protecting natural areas, using recyclable building materials, saving energy, and rainwater harvesting should play an active role in architectural design. Within the scope of the study, these concepts and criteria, which support human health, quality of life and well-being, aiming for a harmonious and balanced architecture with nature, constitute the research problem as integrated design inputs. In this context, a classification for integrated design inputs is proposed. It is essential to consider these inputs in interaction with each other in the design process. It is thought that the classification of integrated design inputs in the nature-architecture relationship are values that architects and designers should use.

Keywords: Integrated Design Inputs, Building Biology, Biophilic Design.

1. INTRODUCTION

The relationship of humans with nature began with an instinctive need for shelter before architecture, enriched with the formation of civilizations and the development of social life, and has reached the present day. The most important milestone in this relationship in the historical process has been the Industrial Revolution. The standard mass production approach that appeared after the Industrial Revolution affected the discipline of architecture; in this case, buildings that ignored environmental values were built. With these unhealthy and uncontrolled constructions and migrations, environmental problems, crowded places, and physically and mentally damaged people have emerged (Güler, 2000).

The human desire for a safe built environment and for developments in all periods to be related to nature and biology has never been stronger throughout history (Akman, 2013). Especially towards the end of the 20th century, the relationship between nature and architecture and the questioning of this relationship has become one of the most important problems. The rapid increase in the human population, industrialization, increase in the amount of greenhouse gases



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in the atmosphere, human desire to dominate nature, etc. have caused damage to the ecosystem and the natural environment (Emekci, 2021).

For this reason, architects have many different points to consider in the design of the built environment. Beyond the customer's property budget, safety regulations, etc., architects have a wide range of responsibilities such as energy efficiency requirements, healthy building design, and the use of recyclable building materials (Ece, 2018).

There have been many studies on the relationship between nature and architecture. Concepts such as organic architecture, sustainability, ecological design, biomimesis, biophilic design, etc. have rapidly gained importance on a global scale and research has been developed on these topics. All these concepts are based on the aim of achieving the highest level of human and environmental health.

This study aims to benefit from building biology and biophilic design concepts in the context of determining parameters that positively support human physiology, psychology, and behavior in the built environment. It would be correct to understand and answer the search for solutions to the problem of the nature-architecture relationship with the help of building biology and biophilic design. The aim of the study is to analyze existing criteria through these concepts and develop a classification that strengthens the connections between nature and architecture.

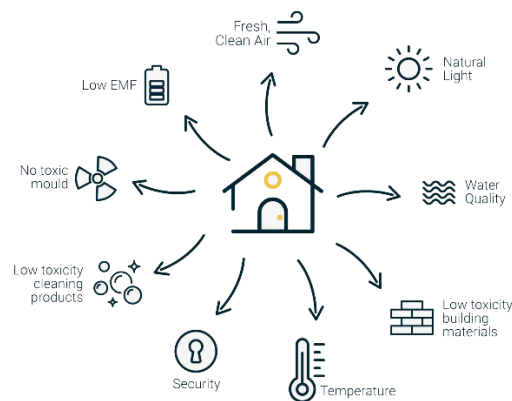


Figure 1. Building biology and biophilic architecture (XUL Architecture, 2022)

1.1. Building Biology

The building is an artificial environment that can respond to different needs of people, is designed within the natural environment, and can provide comfortable, safe and healthy environments for people. The built environment is an indicator of our mental development, health and social status. Building, human and nature are in direct interaction and for this reason, while buildings are designed for the needs of people, they should also be in harmony with nature. Buildings that are not designed in harmony with nature negatively affect people's comfort, health and well-being (Akman, 1990). For this reason, the concept of "building biology" is important in order to prevent building-related health problems.

The concept, which first appeared in Germany as "Bau-biologie", was formed by the combination of the words built and life. It is defined as the study of the holistic relationship between people, built and life. Building biology combines functionality in architecture with the integration of artistic aesthetics, health and eco-social aspects. It focuses on various subject



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areas ranging from urban coexistence in ecosocial communities to interior spaces that support human well-being and health (Ece, 2018). Building biology is the teaching of the holistic relationships between the user and the environment; it is the branch of science that examines the effects of structures and spaces on human health. When the relationship between biological principles and settlement requirements cannot be established, the design becomes simplistic, soulless and irresponsible. Today, people spend 90% of their lives in closed artificial environments that conflict with the natural environment, making it necessary to design healthy structures for mental and physical illnesses (YBE, 2021). The qualities of the artificial environment such as walls, floors, ceilings, interior fittings, etc. need to be taken into account. It is important to apply the principles of architectural psychology in terms of space, color and scale in order to nourish the spirit, support healthy building designs and qualify for arts and crafts. To protect the natural environment, renewable and regional resources, renewable energies, energy-efficient and resource-conscious methods should be preferred and the use of environmentally harmful substances should be minimized (Ece, 2018).

This approach, defined as "Prudence for Health Risks", is common in communities where environmental awareness is important. Instead of being obliged to repair the environmental damages caused by the building and to treat the physical and mental illnesses it causes to human health; it requires designing a building that will protect humans and environmental health (YBE, 2021).

Building biology is a tool to evaluate our built environment with universal standards of health, social responsibility, sustainability and aesthetics. It helps us to lead healthy and lives in prosperity, respecting the natural environment. It focuses on human health, environmental sustainability and protective measures on the building; using a humane and ecological methodology that seeks to establish a balance between nature and architecture (Ece, 2018).

There are 25 basic principles of building biology (Fig.2), covering the building site, building methods, building materials, indoor climate, and how to deal with the environment, energy, and water. These principles are categorized under 5 main criteria; healthy indoor air, thermal and acoustic comfort, human-based design, sustainable-environmental performance, and socially connected and ecologically sound communities (Louise, 2020).



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Figure 2. The 25 guiding principles of building biology (Louise, 2020)

In summary, building biology focuses on issues of the suitability of the building material, acoustic insulation, energy efficiency, air quality, human health-oriented indoor climate, psychological compatibility, water cycles and geological suitability of the construction area, etc. (Akman, 1999). Buildings designed based on the principles of building biology create a healthy indoor climate, are in harmony with their environment and fulfill ecological requirements that can meet user-community needs.

1.2. Biophilic Design

Biophilia is defined as people's need for nature for physical and mental health and their innate desire to be in touch with nature (Kellert, 2014). The concept, first mentioned by psychoanalyst Eric Fromm, means "love of life" (Akyıldız Arda, 2023).

Studies display that human well-being is connected to the natural environment and that human will need connections that strengthen their relationship with nature throughout their lives. For this reason, it is important to adapt the concept of biophilia to the architectural design discipline in order to create the connections that humans need in the physical environment.

The use of the concept and criteria of biophilia in architecture is defined as biophilic design. Biophilic design, which requires interdisciplinary work, argues that human health and well-being will be possible through the use of natural elements in architectural design, allowing human-nature interaction in the built environment to be sustained in a healthy way (İrfanoğlu and Suri, 2022). It supports the nature-architecture-human relationship and emphasizes the design of the built environment together with natural elements (Akyıldız Arda, 2023). It focuses not on minimizing negative human impacts, but on harnessing nature's ability to enhance human well-being in design (Grazuleviciute-Vileniske, Daugelaite & Viliunas, 2022).

Biophilic designs have many positive physical, mental and behavioral outcomes:

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- Physical outcomes include lower blood pressure, increased comfort, fewer symptoms of illness, more health, and faster healing.
- Mental outcomes include increased motivation, less stress and anxiety, more creativity, and improved problem-solving skills.
- Behavioral outcomes include coping, increased concentration, improved social relations, and less aggression (İrfanoğlu & Suri, 2022).

There are 14 basic principles of biophilic design (Fig.3). These principles are categorized under 3 main criteria; nature in the space, nature analogue, and nature of the space (Browning, Ryan & Clancy, 2014).

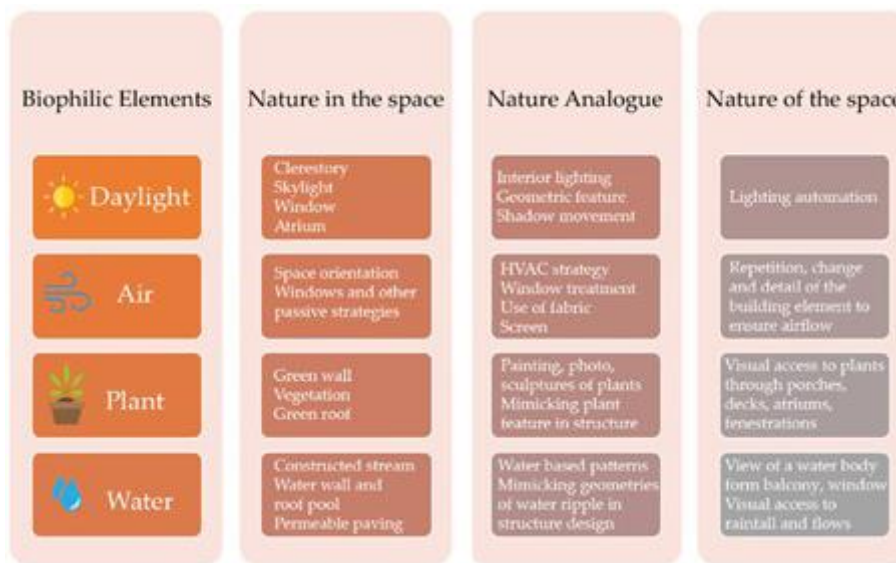


Figure 3. 14 Patterns of biophilic design (Nitu, Gocer, Wijesooriya, Vijapur & Candido, 2022)

The focus of biophilic design is the application of the sense of human evolutionary connectedness to nature in architectural design. Interacting with biophilic design criteria allows people to feel physiologically, mentally and psychologically well.

2. MATERIALS and METHODS

There are many practices and criteria under different categories in the nature-architecture relationship. In order to better perceive and systematize the possibilities provided by building biology and biophilic design approaches, it is aimed to develop a classification that explains the connections between nature and architecture. As a result of all these analyses, integrated design approaches in nature-architecture relationships have been developed. In addition, the potential of these approaches on the nature-architecture relationship has been evaluated.

3. FINDINGS and DISCUSSION

The lack of a general classification that explains and integrates all aspects of the criteria related to the nature-architecture relationship has been revealed. For this reason, a universal and systematic classification was made within the scope of the study. The inputs in the classification



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are aimed to strengthen the connection and synergistic energy between the architectural design of the building and nature.

Integrated design approaches in the nature-architecture relationship are classified under 7 basic principles (Fig.4, 5); building materials, natural lighting, natural ventilation, acoustic comfort, energy-efficient building design, design according to the Earth's magnetic field, water efficiency - rain harvesting.

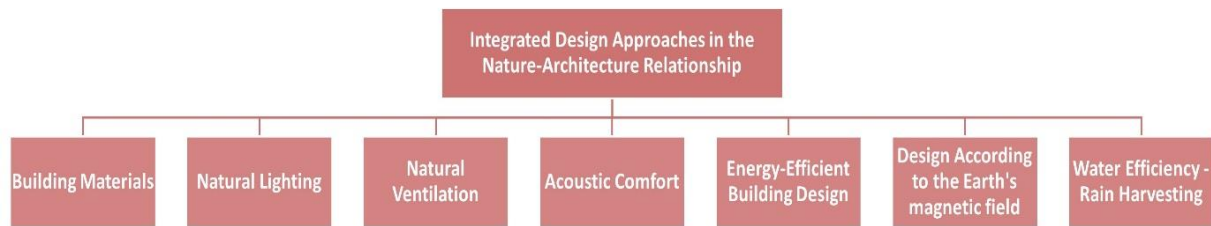


Figure 4. 7 Basic principles of nature-architecture relationship (created by authors)

1. Building Materials

Building materials constitute 20% of the negative environmental impacts caused by the built environment throughout its life. When selecting building materials, they must be recyclable and reusable (Emekci, 2021).

Criteria such as the amount of energy required during the production process of materials, their usability during the production process, their availability from local resources, production and application possibilities outside large facilities, their effects on personal health and the comfort level of the environment should be taken into account (Eriç and Ersoy, 1995). The selection of materials, especially according to sustainability principles, reduces the destruction of buildings in the natural environment, increases energy efficiency, reduces maintenance and repair costs, and creates healthy environments for users (Sev, 2009).

In addition, it is also important to use the selected building materials effectively and efficiently (Emekci, 2021).

2. Natural Lighting

Lighting is important for issues such as improving image quality, protecting eye health, and ensuring concentration. As a result of inappropriate lighting; eye fatigue, irritability, and headaches occur; quality of life and management productivity decrease.

Natural lighting, which is the most appropriate lighting, is realized by letting daylight into the space from the window or roof. In the use of daylight in lighting, attention should be paid to issues such as the light coming directly into the eyes and the presence of glare in the working environment (Güler, 2005).

In building design, the orientation of the building is important in order to benefit from natural lighting. Windows, which are the most important building element in natural lighting, should be designed for the climate in which the building is located. Building elements such as light tubes, light shelves, skylights, etc. can also be used to benefit from natural lighting (Emekci, 2021).



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3. Natural Ventilation

One of the most important inputs in the nature-architecture relationship is the ventilation of spaces. In cities, the amount of CO₂, SO₂ and CO increases in the breathing air; in some buildings, materials release radon compounds and reduce the ions in the air by radioactive emissions. As a result, fatigue, breathing difficulties, weakened immune systems, and chronic and psychological diseases occur (Akman, 1990).

Air conditioning systems aim to achieve indoor air quality. ASHRAE (2001) standards define acceptable indoor air quality as particle levels that are in accordance with values determined by competent authorities and more than 80% of people are not disturbed by the air quality. Therefore, natural ventilation is important in buildings.

The aim of natural ventilation is to remove the polluted air out of the space by air circulation and to allow fresh air and oxygen to enter the space. Removal of polluted air is possible by circulating natural air within the building (Ersoy, 1994). Natural ventilation allows fresh air to enter the interior by expelling polluted air, balances the relative humidity indoors and removes hot air from the building when cooling is desired.

4. Acoustic Comfort

Noise is defined as a sound pattern that affects the physical, mental, and sociological health of people with the elements it contains. In addition to hearing problems, it can cause various diseases by affecting the nervous and cardio-vascular and respiratory systems (Güler, 2005). For these reasons, especially indoor acoustic comfort and sound insulation are important in architectural design.

Sound insulation can be achieved by coating the external wall of buildings with cladding materials, laying polystyrene-based materials under parquet and ceramic tiles, covering pipes with sound-absorbing materials, making double-glazing windows, crafted sound-absorbing ceiling and wall coverings, etc. (Ekinci, Işıksolu, Demirci, Ozan, İşçi ve Aydın, 2005).

5. Energy-Efficient Building Design

Energy-efficient building includes sustainability criteria related to human and environmental health. These criteria range from insulation level to indoor climate, from the use of radiant heat for heating to the use of renewable energy sources. Strategies such as the selection of appropriate systems, solar heat recovery, and conscious user behavior in heating and ventilation contribute to energy savings (Ece, 2018).

Energy efficient criteria in building design should be considered at all stages of design. Renewable energy sources such as solar, wind, sea, hydroelectric, bioenergy, geothermal, etc. found in nature, should be used as much as possible.

Energy efficiency should also be achieved through passive heating and cooling techniques (Emekci, 2021).

6. Design According to the Earth's Magnetic Field

Nature is dense with electrical and magnetic energies. Every energy has a magnetic moment. Human health can be negatively affected as a result of the effect of magnetic fields; it is known that cancerous cells can develop. It has been proven to have an effect on health issues such as tissue regeneration, body weight change, oxygen utilization, etc. For this reason, in building

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design, attention should be paid to issues such as preventing ferromagnetic deformation, and preventing artificial magnetic alternating fields generated from electrical installations and electric vehicles (Akman, 2013).

7. Water Efficiency - Rain Harvesting

One of the most important resources of our biological earth is water. Water is consumed unconsciously due to problems such as global warming, uneven urbanization, environmental pollution, etc. This situation will bring drought.

In order to water conservation, water should be recycled and reused. In strategic landscaping practices, less need for irrigation can be achieved by using climate-appropriate landscaping.

In particular, collecting and utilizing rainwater is a current and important approach to water efficiency. By collecting the drops falling on the roof and facade, all the water needs of a building can be met (Emekci, 2021).

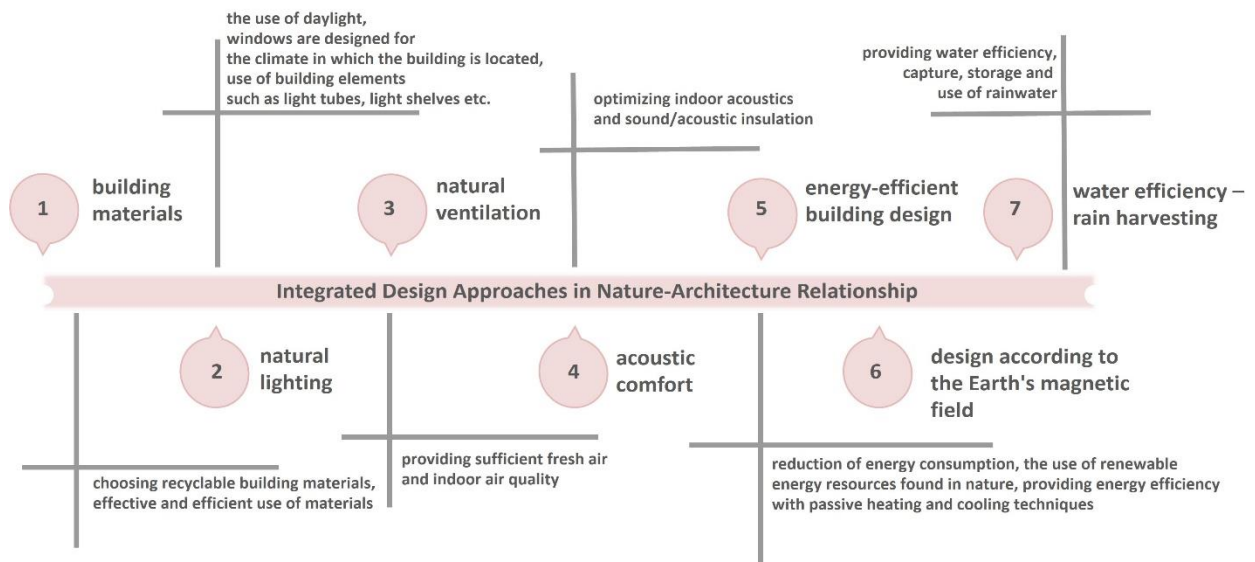


Figure 5. Integrated design approaches in nature-architecture relationship (created by authors)

4. CONCLUSION and RECOMMENDATIONS

In the nature-architecture relationship, design inputs that directly affect physical and mental health cannot be effective on their own. For this reason, it would be correct to approach the inputs mentioned in the study as integrated design inputs and to use them in architectural design.

These inputs, which include many issues such as urbanization, protection of natural areas, physical environmental control, energy efficiency, sustainability, rainwater harvesting, etc., when used in an integrated approach to design, will provide important contributions to current and future architectural problems and issues related to human physical, mental and behavioral health. The proposed integrated design inputs provide solutions for mechanical deformation, thermal factors, water and humidity effects, sound and noise problems, etc.

It is important to handle these inputs in interaction with each other in the design process. It is thought that the classification of integrated design inputs in the nature-architecture relationship are values that should be used by architects and designers.



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The study aims to raise awareness in theory, and especially in architectural practice, on the classification and integrated use of inputs.

Thanks and Information Note

The paper complies with national and international research and publication ethics. Ethics committee approval was not required for this manuscript.

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**EXAMINATION OF GREEN INFRASTRUCTURE PHENOMENON IN THE
WORLD**

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ABSTRACT

Today, human beings have begun to pay the price for the natural resources they consume and damage, the environment they pollute, and cultural corruption. Especially environmental problems, climate change and its effects are the most important examples of this cost. Countries that are aware of the situation are looking for solutions and are in a hurry to take precautions. However, the solution does not seem easy at all. "Green infrastructure systems", produced as a nature-based solution to some of today's chronic and critical problems, constitute the main subject of this study. The aim of the study is to reveal the green infrastructure phenomenon in the sample countries (America, England, EU, Japan, China, India, Iran, Türkiye) examined. In the study, the green infrastructure phenomenon in the sampled countries was examined on the basis of corporate reports and projects, legislative documents and relevant literature. The findings showed that countries have differences in the institutional and legal structuring of green infrastructure, incentive systems, reflection on practice, and perception of scale. In conclusion, basic recommendations have been developed for the implementation of green infrastructure in all countries.

Keywords: Green Infrastructure, Open Green Spaces, Greenways, Urban Planning.

1. INTRODUCTION

The world population is increasing rapidly and more than half of this population lives in cities. Life in cities is becoming more intense every year. The figures reported by the United Nations, the World Bank and many other international institutions are not encouraging at all.

Although cities cover only 2% of the world, they consume more than two-thirds of the world's energy. It produces more than 70% of greenhouse gas emissions as the price of modern life. At the same time, cities are the growth engines of the world economy, enabling millions of people to escape hunger. If cities are planned well, world hunger and poor life can be further reduced. Unplanned and uncontrolled growth causes environmental problems, housing problems, increased crime rates, transportation problems, hunger, disasters, climate change, etc. causes (World Bank, 2023).

Today, cities consume enormous amounts of energy, produce mountains of garbage, require massive infrastructure investment, and are also the focus of poverty and disaster risk. This situation gets worse in cities where urbanization and population density are rapid, poverty is



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high and planning is poor (UNDR, 2013). Climate change further triggers this situation in cities. Thus, cities play the role of the engine of the economy on the one hand, and the trigger of disaster on the other (Cities and Regions, 2023). Globally, annual losses from disasters in the built environment are estimated at \$314 billion. By 2030, this figure is expected to increase to 415 billion dollars. It is also estimated that more than 77 million people may be dragged into urban poverty (World Bank, 2023). In addition, future predictions say that the urban population exposed to hurricanes will increase from 310 million to 680 million in 2050, and those exposed to major earthquakes will increase from 370 million to 870 million (UNDR, 2013).

Cities are important to provide a better future for the world and humanity. Cities; sustainable, high environmental quality, resilient, fair, equitable, safe, etc. should be transformed into urban systems. The main subject of this study is "green infrastructure", which plays a key role in creating sustainable urban systems and is also considered an important tool in today's climate change fight and adaptation process. In the study, the current situation in the world is presented by examining the perception of GI within the scope of the sampled countries.

1.1. Green Infrastructure Concept and Its Importance

The seeds of Green Infrastructure (GI) were planted with the "green road" projects produced by Frederick Law Olmsted in the 1870s with the aim of connecting city parks. In 1903, Olmsted stated that "parks should be connected to each other and to the surrounding settlement to preserve biodiversity, prevent habitat fragmentation, and ensure equal access for people." Connecting the parks to each other started the modern greenway movement. The modern greenways movement has also influenced GI planning and implementation. It should also be noted that wildlife biologists and ecologists already know this situation for the continuity of ecological processes and biodiversity. Because "connectivity between open green spaces" is a key concept for conservation biology science and ecosystem management practices (Benedict & Machon, 2002). GI was used a "term" by local authorities in Florida in 1994 to refer to a natural and ecological system that is important in developing land conservation strategies. In addition it has been stated that it is as important as gray infrastructure (Firehock, 2010).

The President's Council on Sustainable Development, in 1999, identified GI as a strategic area that provides a comprehensive approach to sustainable social development. It has been stated that in the GI approach, ecological, social and economic functions are understood and ways to benefit from them are presented. The Council's 1999 report stated that "GI strategies actively seek to understand, exploit and value the different ecological, social and economic functions provided by natural systems, with the aim of protecting ecosystems as well as guiding more efficient and sustainable land use and development patterns." The Conservation Fund and the USDA Forest Service created the GI Working Group, which consists of government agencies and nongovernmental organizations. The group was convened to develop a program to help make GI an integral part of local, regional and state plans and policies. GI was defined for the first time within the scope of the studies.

The first definition for GI was made as follows; "*infrastructure is our nation's natural life support system: an interconnected network of waterways, wetlands, woodlands, wildlife habitats and other natural areas; greenways, parks and other conservation lands; working farms, ranches and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for America's communities and people*" (Benedick & McMahon,



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2002). Guided by this definition, there are many similar definitions of GI. However, this definition can be considered the most basic and general definition.

The terms “nature-based solutions”, “green infrastructure” and “natural infrastructure” are sometimes used interchangeably. The Environmental and Energy Study Institute in America expressed the difference as follows. Nature-based solutions are generally projects that incorporate natural features or processes into the built environment. GI, on the other hand, is generally expressed as projects that combine gray infrastructure with nature-based solutions to create hybrid systems that increase resilience to climate impacts. Natural infrastructure, on the other hand, are projects that use existing or reconstructed landscapes (e.g. forests, floodplains and wetlands) to increase resilience to climate impacts (NCSL, 2022).

Although GI and greenways have a common origin, GI and greenways differ from each other. These differences are (i) GI highlights ecology, not recreation (ecology and recreation) (ii) GI provides important landscape connections as well as ecologically important centers (large-small area) (iii) GI can shape urban form, direct growth (growth framework) (Benedict &McMahon, 2002).

In many studies, GI is considered a means of establishing “connections” between green spaces (Davies et al., 2015). However, this bond is a strategically planned bond with ecological-economic-social-cultural aspects and enables the creation of a network. It is also involved in public processes (Benedict and McMahon, 2002; McDonald et al., 2005; Benedict, 2006; Hellmund &Smith, 2006).

GI is a system of “hubs” and “links”. The system consists of natural and restored ecosystems and landscape features. Hubs anchor GI networks. It ensures the mobility of wildlife, in other words, it ensures the flow of energy. They are areas of continuity of ecological processes. There are cores in the middle of the hubs and they are very sensitive. Links connect the centers or the system (Figure 1). It keeps the GI networks functioning. Hubs and connections vary in size, function, and ownership. Long-term planning, management and protection are necessary for the success of the system (Benedict & McMahon, 2002).

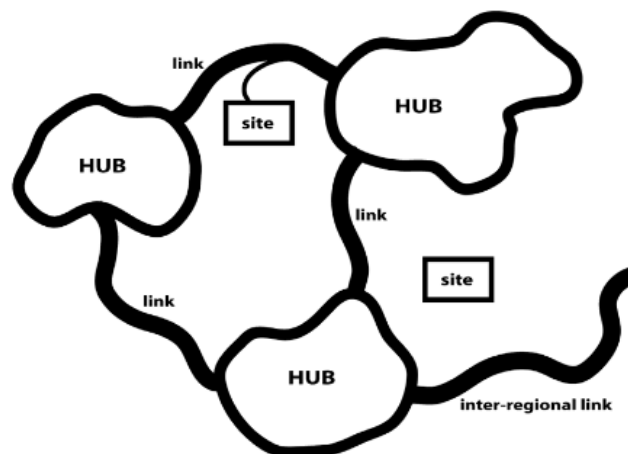


Figure 1. GI network components (Benedict & McMahon, 2012).

GI systems promote ecological, social and economic benefits. These benefits include; health, agriculture and forestry, water management, education, tourism-recreation, disaster prevention

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and management, combating climate change-adaptation, resilience, low carbon emissions and energy, land and soil protection, investment and employment, and increasing efficiency of natural resources. GI supports, strengthens and directs many different areas (Figure 2). These benefits ultimately help protect and restore ecosystems, in other words, support ecosystem services and sustainability.

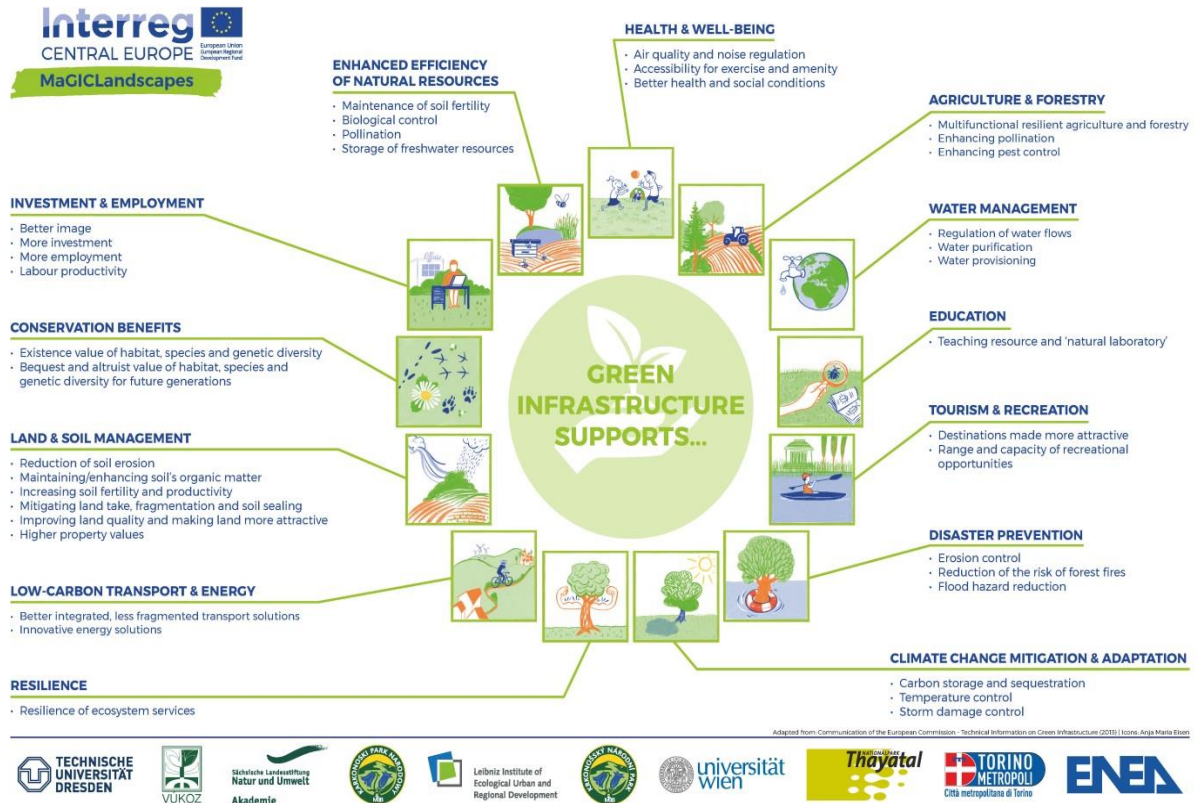


Figure 2. Benefits of GI (European Commission, 2013)

The GI system is planned based on various principles. These are expressed under 7 headings (McQueen & McMahon, 2003):

1. It should serve as the framework for conservation and development.
2. Planning and design processes should be established before development plans.
3. Links are essential components.
4. Must be able to multitask at different scales.
5. It should be constructed in line with land use planning theories and practices.
6. It is an important public investment.
7. Requires participation of various stakeholders.



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1.2. GI Phenomenon in the World

United States (US)

GI was born in the United States with the planning philosophy of Frederick Law Olmsted. It guided the planning of cities in the USA in the 19th century (Benedict and Machon, 2002). Ian McHarg, who emphasized the development of cities on the basis of natural processes in the 1970s, nourished this approach. Philip Lewis, on the other hand, pioneered the protection of stream valleys and natural corridors in the urban planning process, actually emphasizing the importance of protecting GI components. New Urbanism movements, on the other hand, have nourished GI systems with the goals of protecting and developing open green areas (Parlak et al., 2022). Many urban planners and writers have developed and directed awareness in the USA by emphasizing the importance of open green spaces for the city.

There are different legal forces pushing the GI program in the USA. There are forces pushing the GI program in the USA. At the federal level, the "*Clean Water Act (1972)*, *EPA Low Impact Development program (1990)*, *EPA Innovative Wet Weather Grants (2005)* süreci yönlendirmiştir. Yerel düzeyde *Combined Sewer Overflow lawsuit (1991)*, *Bureau of Environmental Services Sustainable Stormwater Division (2002)*'nin kurulması, *Water Quality Friendly Streets (2003)*, *Watershed Management Plan (2006)*, *Grey to Green Initiative (2008)* (Fukuoka & Kato, 2015).

Today, land in the US is being consumed and fragmented faster than ever before. Because the population is increasing rapidly and cities are expanding. Conclusion; loss of Natural Areas, Fragmentation of Open Spaces, Degradation of Water Resources, Decreased Ability for Nature to Respond to Change, Loss of Free, Increased Costs of Public Services, Natural Services Increased Taxes. Open green areas are constantly turning into residential areas and the protection of lands is an important problem (Benedict and Machon, 2002). The effects of extreme weather events are increasing day by day, and the priority of states is to reduce the effects of extreme weather events. States are increasingly adopting policies to develop, implement, and finance GI projects. They are integrating these projects into existing hazard mitigation plans. The federal government is also increasingly prioritizing disaster mitigation investments, and especially nature-based solutions. At this point, states have conflicting budget priorities. Additionally, pre-disaster mitigation investments/nature-based investments/GI investments compete with immediate response needs and other infrastructure concerns. On this subject, the nature-based National Institute of Building Sciences published a 2021 report showing that every \$1 invested in mitigation efforts provides a \$13 return on investment. This data is a powerful tool for states in determining spending priorities. The US Environmental Protection Agency estimates that improving stormwater and public wastewater systems across the country will require at least \$150 billion over the next 20 years. He states that GI systems can solve this problem. GI is viewed as a system that "*expresses landscape features and solutions that mimic, use or restore natural ecological processes.*" It is also emphasized that GI projects are "*an innovative approach to stormwater management that can protect water quality and increase a state's climate resilience*" (NCSL, 2022). The ecological-environmental, economic and socio-cultural benefits of GI systems are now recognized across many different sectors and platforms in US (EPA, 2023).

The main agency supporting GI in the United States is the United States Environmental Protection Agency (EPA). EPA defines the advantage of GI as "*Benefits of Green*



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Infrastructure.” It also states that GI has 11 elements. These are “downspout disconnection, rainwater harvesting, rain gardens, planter boxes, bioswales permeable pavements, green streets and alleys, green parking, green roofs, urban tree canopy, land conservation” (Kida, 2017).

In the USA, GI is an issue that is emphasized on the basis of different scales. For example, it is often emphasized that GI produced at the basin scale makes the benefits for water quality more evident. For this reason, the importance of planning at the national/basin scale is emphasized (EPA, 2023). At the lower scales, state governments see GI systems as tools to meet public needs. Therefore, in order to meet land use and building requirements, the GI requirement has been accepted. In this context, landscape architects and urban engineering consultants provide expertise in GI design. Land owners and developers are also promoting GI aspects of local projects (ABA, 2023).

US GI policies focus on the state or municipal level, such as rebates, expedited permitting, grants and loans. In this sense, many projects have been implemented. Seattle, Chicago, New York are among them. Seattle is the first US city to manage stormwater runoff and improve neighborhood aesthetics (2006). The Seattle Green Factor (SGF) and the GI City Policy is the architect of Seattle. 2013 created a city policy to reduce combined sewer overflows through GI projects (*with bioretention swales, rain gardens, and green roofs*). A number of financial programs have also been developed for projects of different sizes. The most notable fiscal stimulus in Seattle has been tax abatement programs. The program offered “*tax breaks to property owners who install green roofs or on-site stormwater management systems.*” The program provided “*a 50% exemption on B&O taxes and a 75% exemption on city property taxes for up to 10 years.*” A “rebate program called RainWise that covers most or all of the rain garden installation” has been created for small areas. Additionally, “*Seattle's Priority Green Expedited Permitting Program*” was developed, offering a streamlined permitting process with a discounted fee for GI development projects. Thus, air-water quality in Seattle improved, greenhouse gas emissions decreased, active-sustainable transportation was encouraged, and the policies developed became a good example for other cities (Zakrisson, 2023).

GI is also reflected in federal and state legislation in the USA. This situation also increases the sanctions. For example, The Water Infrastructure Improvement Act of 2019, GI “*the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate or evapotranspire stormwater and reduce flows to sewer systems or to surface waters*” (NCSL, 2022).

England

1873 British prime minister William Pitt considered the city's parks and squares the “lungs of London”. His comment can be considered the first political discourse on the GI system in the country (URL 2023a). Also, England has guided the urban planning journey in the light of urbanization approaches and political discourses in US.

Today, open green areas in England are the red line of construction policies (Tuna 2021). In this context, GI is instrumental for improving urban quality of life and creating climate-resilient towns and cities. The contributions of GI projects are evaluated under the headings of air quality, surface water management and water quality, biodiversity, health and welfare (Natural England, 2023).



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The UK Government's natural environment advisor in England, "Natural England", is a follower of GI process (Natural England, 2023). GI has been supported by central government, Local Planning Authorities (LPA), the development sector and environmental advocates. Support from the UK government and its subsidiaries (i.e. Natural England, the Forestry Commission and the Environment Agency) has increased since 2005. Institutions responsible for GI are Community Forests, Local Planning Authorities (LPA), Environmental Organizations (i.e. Forestry Commission, Wildlife Trust), Friends/Community groups (Mell et al., 2017).

GI is also supported by legislation. It is working with the UK Department for Environment, Food and Rural Affairs (DEFRA) and other stakeholders to develop the "Green Infrastructure Framework", a commitment of the Government's 25 Year Agreement (Natural England, 2023). Community Forests, Local Planning Authorities (LPA), Environmental Agencies (e.g. Forestry Commission, Wildlife Trust), Friends/Community groups are responsible for GI (Mell et al., 2017).

There are national, regional and local policies on GI. There is the National Planning Policy Framework (NPPF) on a national scale, The Local Plan (GLA), Cambridgeshire Green Infrastructure Strategy, 2nd Edition on a regional scale and Liverpool Green Infrastructure Strategy (Mersey Forest) on a local scale (Mell et al., 2017).

There are impressive examples of GI. These; London Olympic Park, Chavesse Park (Liverpool), Great Fen Project (Huntingtonshire), Winter Gardens (Sheffield), Swansea Bay (Swansea), Herrington Country Park (Sunderland) (Mell et al., 2017).

The Cambridge Green Infrastructure Strategy provides a nationwide framework for delivering or improving GI in Cambridgeshire by 2031. Strategies also show how GI contributes to "reversing the decline in biodiversity, mitigating and adapting to climate change, promoting sustainable growth and economic development, and supporting healthy living and well-being".(URL 2020). Proe is already an impressive guide with successful results.

European Union (EU)

The issue of GI has begun to attract attention in the European Union since 2011. This interest focuses on "reducing biodiversity loss and promoting sustainable resource use." Additionally, GI has been recognized as "embodying the spatial representation of sustainability." In this context, it was decided to revitalize the landscape value to improve GI. In this context, declarations and reports have been published and projects have been developed (Fesel, 2020).

European Commission; It sees GI as "a successfully tested tool to deliver ecological, economic and social benefits through natural solutions" (European Commission, 2023). The Commission, Cohesion Fund and European Regional Development Fund (ERDF) define GI applications as a priority investment area (Tuna, 2021).

The GI system is encouraged in all EU policies to restore nature and increase biodiversity. GI is a network of natural and semi-natural areas that provide a wide range of ecosystem services. It is a strategic plan (European Commission, 2023).

In the declaration published by the European Commission in 2013, the principles regarding GI were expressed as "*GI is important for the protection and development of nature, natural*



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processes and the many benefits that individuals derive from nature" and "It should be integrated into spatial and regional development" (Tuna, 2021).

The EU's Green Infrastructure Strategy calls for GI to be an integral part of regional development. The Europe 2020 Growth Strategy points out that GI can make a significant contribution to many areas. The Biodiversity Strategy aims to ensure the maintenance and development of ecosystems and their services by creating GI and repairing at least 15% of the damaged ecosystem by 2020 (Dige, 2015).

GI has also been recognized in different areas of EU policies, especially within the Seventh Environmental Action Program (7EAP), Regional Policy 2014–2020, Water Framework Directive, Nitrates Directive, Floods Directive and the EU Strategy on Adaptation to Climate Change (Dige, 2015).

As a result, there are impressive policies regarding GI in the EU. The EU's GI policies have the goal of promoting the use of clean energy sources, reducing emissions and increasing resource efficiency. Establishing high-level directives, financing and incentives at EU, national and local levels. Incentives are given such as tax deductions, project grants and loans. There are very comprehensive directives on this subject and financing opportunities are provided. The main EU financial incentives for GI projects are provided by the European Structural and Investment Funds (ESIF), which constitute a significant part of the EU budget, allocated to strengthen the economic-social cohesion of member countries. The Cohesion Fund is another source of projects. The European Investment Bank (EIB) also supports the process by providing loans (Zakrisson, 2023).

There are impressive examples and projects of GI projects in EU member countries. Hamburg (Germany) is one of the leading cities in the EU in GI policies. Hamburg has a comprehensive green roof strategy. The goal is to create roof gardens and green the roofs in at least 70% of new buildings. The Hamburg Ministry of Environment, Climate, Energy and Agriculture has supported the project with 3.5 million Euros until 2024. In addition, various financial incentives and supports have been offered to the residents and businesses of the city of Hamburg. Within the scope of the project, GI policies have proven to be successful in Hamburg. Policies have demonstrated how cities can simultaneously use GI initiatives to achieve environmental and financial goals. Austria is another important country regarding GI projects. Many municipalities in Austria have focused on afforestation to tackle climate challenges. At the same time, they have chosen to protect against heavy rainwater events and reduce energy consumption with green roof and green wall technologies. Today, the green roof and green wall industry has turned into a big industry. Additionally, 20 research institutes are working on innovative solutions for smart cities and urban GI projects. The green roof association Grün-Statt-Grau is very influential in making Austria greener. Additionally, Vienna has adopted a proactive approach to GI. Another city that offers impressive examples of GI is Amsterdam (Netherlands). Its goal is to be carbon neutral by 2050. He considers GI an important tool for this goal. The government offers subsidies for green roofs, green facades, rainwater harvesting systems (Zakrisson, 2023).

Chinese

The central government has launched a series of campaigns, policies and regulations to reflect environmental concerns in its cities, which have become known for their entrepreneurial nature



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in the post-period From the 1990s to the present (Xu and Chung, 2014). The “green is gold” rhetoric of Xi Jinping, China's top leader since 2012, has supported GI development in China today. However, China's GI theory is relatively weak and public participation/awareness is relatively low (Zhou, et al., 2022).

China's latest national urbanization plan, the National New Type Urbanization Plan (2014–2020) (NNUP), has highlighted environmentally friendly urbanization. This situation has increased the pressure of green urbanism and urban green projects have increased. Especially the greenway projects with a GI component have increased. Greenway projects first came to the fore in 2010 in the Pearl River Delta (PRD) and were widely adopted thereafter. Greenways projects have been launched in 31 provinces under the leadership of the government (Zhang et al., 2020).

In the process, it has moved beyond the traditional approach to nature-based holistic approaches. As the key to this approach, the Sponge City Program (2013) was initiated. The program is guided by the Ministry of Housing and Urban-Rural Development, the Ministry of Finance and the Ministry of Water Resources. Sponge City Programme; It has GI such as absorbent roads and permeable pavements, rain gardens, parks and wetlands, and built environment measures such as green roofs and rainwater reuse facilities. Between 2015 and 2017, the national government invested in 16 pilot sponge cities (US\$3 billion). It is aimed that 20% of each pilot city land will be built according to sponge city standards by 2020 and 80% by 2030 (Oates, et al., 2020).

In the World Bank Report; It has been stated that «climate change poses a serious threat to China, especially in densely populated and economically critical sea-level coastal cities». It has been emphasized that uncontrolled climate change could reduce China's economic output by 0.5% to 2.3% in 2030. It has been stated that China needs up to 17 trillion dollars of additional investment in GI and technology in the energy and transportation sectors in order to reach net zero emissions by 2060 (Shalal, 2022).

Today, the important component of the transition to urban sustainability in China is seen as the planning and development of forms of GI (Shi & Qin, 2018).

Japan

Japan became the symbol of environmental pollution and ecological problems with rapid industrialization in the 1950s and 1960s. He cleaned up his actions and his environment in the 1980s and 1990s, but devoted all his attention to the energy problem. This was the way he could develop, become stronger and revive his industry. However, it had a deep spiritual, artistic and cultural connection with nature and land, and this relationship made its stance on the economic development-nature-environment relationship different from other countries (Holroyd, 2018). This stance has been important in giving open green spaces a different place in urban planning in Japan.

Japan has examples of GI implementation since the 1960s. However, in most of them, the full potential of the GI concept has not been realized. There is still a lack of a systematic approach. Tokyo, for example, has had dense green space since 1960. However, there is no connection between green areas. But now, the Tokyo Metropolitan Planning Department recognizes the importance of the planning hierarchy, from the national level to the broad regional, prefectural



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and neighborhood, city, town and village levels. It attempts to coordinate green space planning at these levels. It also plans to protect the coastal vegetation and corridor (Kato, 2011).

In the late 1960s, Kohoku New Town in Yokohama city was the first example of GI. It realized a connected, integrated network of open spaces, including various open spaces, pedestrian paths and water. The features of Kohoku New Town are as follows (Kato, 2011):

- He valued open spaces equally over traditional infrastructure
- Used geographical indications to shape development and conservation
- Developed a layered, rather than hierarchical, system of connected parks and pedestrian paths

On this day, the Japanese government recognizes GI in the national spatial strategy. In Japan, GI is increasingly recognized as a new concept that combines various fields such as environment, urban development, and disaster prevention/mitigation (Kida 2017). GI aims to benefit from the various functions of the natural environment, improve local attractiveness and living environment, and prevent/mitigate disasters (National Spatial Strategy, 2015). In addition, Japan has created GI technology on an urban scale, based on natural, cultural, social and economic situations specific to the country. In this context, three more elements were added to EPA's 11 GI elements. These; green parks, wall greenery, lawn square ground (Kida, 2017).

With the beginning of the scientific and technological revolution in the 21st century, the Japanese government and various prefectures across the country have believed that invention-innovation-transformation will be the most effective means of preventing environmental problems. This belief combined science and technology with the imperatives of the age of environmentalism. Today, demands for environmental adaptation, technological transformation opportunities and economic development imperatives in the fight against climate change have turned into a comprehensive national movement. In particular, the fact that climate change threatens economic and ecological well-being requires green strategies that will reduce emissions and promote economic growth (Holroyd, 2018). At this point, Japan make successful progress. Tokyo, the world's largest and most successful megacity, is a global leader in urban design, rapid transportation and environmental measures (Holroyd, 2018). In Tokyo, open green areas and GI, which ensures the systematic planning and design of these areas, are protected and developed because they provide sustainable living (Wybe, 2014).

There are municipalities in Japan that implement GI to combat heat islands. However, managers state that the desired success has not been achieved. GI Tokyo Biodiversity Strategy for 2030 has also been announced in terms of combating climate change and protecting biodiversity. The strategy highlights the heat island mitigation effects of green spaces, roofs and walls and is important in improving GI. Today, The Tokyo Metropolitan Research Institute for Environmental Protection is investigating the effects of improving the GI thermal environment and they plan to use the findings for future environmental management measures (Giseburt, 2023). In this context, the Japanese Government has set targets to achieve zero greenhouse gas emissions by 2050 and promote the digital transformation of the Japanese economy. Some tax incentives have been introduced to achieve these goals. These incentives were introduced as part of the broader Industrial Competitiveness Enhancement Act. Additionally, on March 26, 2021, Japan's 2021 Tax Reform Bill (the Bill) was signed into law. The law provided tax incentives for Carbon Neutral and Digital Transformation investments. On December 22, 2022,



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the government announced the Green Transformation (GX) policy. The policy defines regulatory, financing and technology development priorities for various industrial sectors with a focus on green transformation (EY, 2023). In addition, the Japanese government aims to implement "carbon pricing", which combines "carbon tax" with voluntary "emission trading", starting from 2028 (IM, 2023). These innovations focused on climate change have increased the importance of GI plans in the country. Moreover, the increasing river flood risk in recent years has focused the attention of managers and ecologists in Japan on flood risk management using GI (Ishiyama et al, 2023).

India

More than 30% of India's population lives in urban areas (according to the 2011 Census). Industrialization accelerated migration to cities, and cities developed without planning. Urbanization has caused land scarcity, environmental problems and unfair distribution of urban opportunities. Today, climate change has added new ones to these problems. The increase in extreme weather events such as droughts, hurricanes, forest fires, heat waves and floods is attributed to climate change. Overpopulation, lack of green financing, inappropriate policies and low awareness are the main obstacles to achieving the "Green City" (Chakraborty, 2023).

In India, GI was used for the first time within the scope of environmental policies in the Fourth Five Year Plan (1964-69). With the establishment of the Ministry of Environment in 1980, air-water pollution and protection of natural resources. etc. issues have been brought to the agenda more frequently. In 2014, the Ministry was updated as the Ministry of Environment, Forestry and Climate Change. In 2008, it prepared the National Action Plan on Climate Change (NAPCC) in response to the United Nations (UN) Framework Convention on Climate Change and the UN's Green Economy Initiative. NAPCC has developed Smart Cities Mission and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) projects involving blue and GI. The Smart Cities project focuses on water supply, protection of open spaces, and improvement of quality of life. AMRUT aims to improve water supply, sanitation and green areas (Mankikar & Driver, 2021). With these developments in Indian history, the use of GI has increased. Especially the fight against climate change has taken GI to a different point.

The concept of GI is often used together with "blue infrastructure" in India. It is defined by its involvement in policies at the central, state and sub-regional level. For example, Delhi Development Authority GI refers to trees, lawns, hedges, parks, fields and forests. Blue infrastructure refers to water resources (rivers, lakes, canals, wetlands, floodplains, water treatment facilities). He defines blue-green infrastructure as urban planning where water and land holistically provide environmental and social benefits (IAS PARLIAMENT, 2023).

Important initiatives/projects under the name Blue-Green Master Plan on GI in India. The first of these were prepared for Delhi, Bhopal, Madurai and Bengaluru. Delhi is one of the first cities to include blue-green policies in its 2041 master plan. The main objective of the policy is to ensure synchronized and interdependent planning of water bodies and green spaces. Public participation guides the process (Rajput, 2020). Bhopal of Madhya Pradesh is a city of lakes. It is one of the 100 smart city projects. By protecting and developing green areas on the basis of GI, a sustainable city with a high quality of life is aimed (Bhopal Smart City Development Corporation, 2016). Madurai Municipal Corporation has come up with a blue-green action plan to address water challenges, climate adaptation and flood mitigation faced by the city and the Vaigai Basin. The plan was developed with a participatory approach (Madhan Kumar &



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Vasimalai, 2016). A blue-green action plan has been prepared in Bengaluru to ensure resource security, climate resilience, transition to a low-carbon economy and ecosystem protection (Mankikar & Driver, 2021). In India, GI gains different values depending on the status of the cities (Table 1).

Table 1. Values of GI in Indian Cities (Mell, 2015)

Value	Activity/Process	Location
Ecological	Trees (water, climate and pollution);	Chennai;
	Water (supply, regulation, pollution);	Bengaluru;
	Managed green space Generic green space (regulating, pollution, habit, biodiversity);	Mumbai; New Delhi;
	Generic green space (regulating, pollution, habit, biodiversity)	Karnataka; Kochi
Economic	Tree commerce; Retail/property values;	New Delhi;
	Consumer/employee well-being; Health costs	Kolkata; Mumbai;
Social	Communal engagement/cohesion;	Chandigarh;
	Sports and recreation; Health and well-being (mental and physical);	Gandhinagar; Bhubaneswar;
	Housing	Kolkata

Iran

Iran has hardly developed GI components in its planning and urban development programs (Sarihi, 2015).

The main GI in Iran are parks and gardens that serve general functions such as recreational space for the community. The main reason why green spaces in Iran's contemporary cities are poor at micro and macro scales is that the dominant approach to green space development focuses only on green space per capita. In other words, there is an attitude that focuses on quantity. Components of the green network in Iran's contemporary cities lack connectivity with other functional city layers and structures. This situation hinders the environmental, social and economic benefits of green areas (Saboonchi et al., 2018).

Environmental quality is deteriorating in many cities in Iran. Tehran, which has 40% of the country's industry, is one of the most polluted cities in the world. According to the World Bank's latest report in 2018, Tehran reached 10 PM in air pollution. It is among the 62 most polluted cities in the world. In Tehran, 4000 to 5000 people die every year due to air pollution (Boostani and Sadeghiha, 2022). In fact, for the last 20 years in Tehran, the development of new green areas and the improvement of existing green areas is a strategy to reduce air pollution and increase the level of public health (Ahmadi et al, 2017). However, the implementation of the strategy is insufficient. Because the connectivity of green areas in Tehran is low, especially in the central city matrix, there is almost no connectivity. The connection with natural areas is gradually decreasing, which causes environmental problems to increase and the quality of life of the city to decrease (Yazdanpanah et al., 2015).

The division of society into social statuses (high, medium, low) in Iran prevents equal access to public green spaces. As in the case of Tabriz, the public can access green areas at the level



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recommended by the government. The areas with high social status have the best park, and accessibility. Social discrimination is reflected in the approach to planning open green spaces and negatively affects connectivity (Breuste & Rahimi, 2015).

Today, Iran is experiencing alarming levels of floods, storms, droughts, subsidence and forest fires due to the effects of climate change. While the number of disasters was below 100 between 1900 and 1980, this figure was 400 between 2000 and 2019. This situation is attributed to high carbon emissions and climate change (Tourani et al., 2022). Today, the world is criticizing Iran's process of combating climate change. Iran has not signed the Paris Agreement, which is a turning point in the fight against climate change. The embargo and economic impasse negatively affect its fight against climate change and environmental problems. America has even blocked access to the funds allocated to Iran by the Global Environment Facility (GEF) for environmental problems. Iran's discourse on this issue is clear: "You cannot expect a country with serious socioeconomic and political problems to focus on climate change." Under current circumstances, Iran maintains its composure towards the transition to a green economy. In short, Iran clearly states that it cannot combat the threat of climate change in its current situation (Mahoozi, 2020). This situation prevents the development of GI, which is seen as the most powerful tool in combating and adapting to climate change, in Iran.

In scientific studies that do not slow down despite Iran's economic and political situation, GI is presented as a solution in the fight against environmental problems, ecological sustainability, equal access to public spaces, and new urban planning approaches (Breuste and Rahimi, 2015; Ahmadi et al., 2017; Ramyar et al., 2019; Bostani and Sadeghiha, 2022, Rahimi and Breuste, 2023). However, ecology-based planning studies on an urban scale in Iran are a new field. Financial resources are lacking in this sense (Ramyar et al., 2019).

Türkiye

According to the first census carried out in Türkiye in 1927, 75.8% of the population lived in towns and villages and 24.2% lived in provincial and district centers, but after 1950 the population began to gather in urban areas. According to the 2021 results announced by the Turkish Statistical Institute (TUIK), 93.2% of the population lives in provincial and district centers (Ministry of Environment, Urbanization and Climate Change, 2023a). This rapid, unplanned and un-ecological urbanization process has been the architect of cities where the quality of life is low, environmental problems are increasing, natural areas and biodiversity cannot be protected, etc.

The 1972 United Nations Stockholm Human Environment Conference had a great impact on addressing the environmental issue at the policy and management level in Türkiye. This effect has also led to the adoption of many international agreements. In this context, for the first time in Türkiye, III. The environmental issue was emphasized in the Five-Year Development Plan (1973-1977). Afterwards, the environmental issue was increasingly addressed in the legal and administrative structure. This situation has also been addressed in the urbanization process.

The Zoning Law, Zoning plans and relevant regulations have come into force for the planned and rational progress of urbanization in Türkiye. However, it was insufficient to slow down the process and prevent problems. This situation is seen in existing city examples. In order to solve the problems experienced in recent years, the Spatial Plans Construction Regulation (SPCR) dated 2014, which includes the latest updates on the implementation of the Zoning Law, was



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put into practice. The regulation has comprehensive discourses aimed at producing solutions for structural and natural areas. For this reason, it is the key legislation in Türkiye's urbanization process. The most important legal discourse on the planning, design, implementation and protection of open green areas in Türkiye is SPCR. There is no GI concept in the regulation because the concept is new for the legislation in Türkiye. When the regulation is examined based on the open green area system, it is inadequate in many aspects, especially conceptual perception, planning principles and ecological approaches. Because open and green areas are seen as only social infrastructure areas (open and closed sports facilities, parks, playgrounds, playgrounds, squares, recreation areas, etc.). The planning, design and projecting of open green areas and the principles and objectives in this process are not given in the regulation. Beyond the holistic approach, there is a fragmented approach for coastal, rural, road and urban areas. It also focuses on a quantitative perspective where green areas per capita are given. This attitude is an indication that the perception of GI system approaches is not included in the Regulation (Karadağ et al. 2019; Demiroğlu et al., 2019; Karadağ et al. 2020).

Open green area plans are prepared within the scope of Development Plans. Zoning plans are prepared according to Basin/Provincial Environmental Plan. The concept of environment is effective in the Basin/Provincial Environmental Plan. However, it is insufficient for green space planning at the city level and lower scale. For this reason, the planning hierarchy cannot go beyond advice on GI. The most effective institutions in open and green space planning and design on a local scale are municipalities. Urban open green area projects are not produced in municipalities. There are no open green area projects at the development plan scale (1/5000, 1/1000) or urban parks and landscape projects for some parks can be accessed in a fragmented manner. However, there are no holistically prepared urban open and green area projects at the city scale. The process is carried out by the Municipalities' Directorate of Planning and Urbanization, Directorate of Technical Affairs, and Directorate of Parks and Gardens. There is no mechanism that provides participation in the project design process (Demiroğlu, et al., 2019; Karadağ et al. 2019). The Urbanization Council held in 2009, within the scope of solving some of these problems, enabled the preparation of the Integrated Urban Development Strategy and Action Plan Preparation Project for Urban Development. The project's final report was declared as Integrated Urban Development Strategy and Action Plan-KENTGES (2010–2023) on March 3, 2010. KENTGES is a road map for central and local governments on urbanization and zoning issues (Ministry of Environment, Urbanization and Climate Change, 2023b). The report includes strategies for planning open and green space systems and protecting existing areas. In this sense, it is very important for Municipalities. In addition, the GI Guide for Municipalities was prepared in 2021 under the leadership of the Urban Research Institute. The purpose of the guide is to guide local governments in terms of theoretical level and implementation steps (19.09.2023) to ensure that they handle all spatial planning and implementation processes within the understanding of GI (Karadeniz & Taşkın, 2021). The recommendations in the aforementioned project and guide are key for all participants in the GI management-planning-design process. However, there is a problem of technical personnel with competent and sufficient knowledge in putting it into practice. In addition, the process may be affected by urban-scale management policies and the power of political authorities (Demiroğlu, et al., 2019; Karadağ et al., 2019).

Today, there are no incentives (grants, loans, funds) in developed countries regarding GI in Türkiye. However, there are strong recommendations on this issue and projects on the subject



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are given priority. For example, Türkiye Ilbank and the World Bank (WB) Sustainable Cities Project was carried out (Ilbank, 2019). In the USD 784 million Sustainable Cities Project, a series of studies are carried out together with municipalities to support climate change mitigation and adaptation, such as rainwater, emergency response, solid waste disposal, renewable energy use, energy efficiency and sustainable transportation in urban planning. The project also seeks ways to increase the resilience of cities. In addition, the Government, with support from the World Bank, has conducted three city-wide disaster and climate risk assessments to identify key infrastructure and housing that require urban resilience investments, such as housing retrofitting, drainage improvements, public space and social infrastructure (World Bank, 2023). All these projects are important developments in terms of the protection, development and planning of GI systems.

2. MATERIALS and METHODS

The study was conducted on the example of America, England, EU, Japan, China, India, Iran and Türkiye. GI systems in countries were examined based on institutional reports and projects, regulatory documents and relevant literature. The review was conducted based on institutional structuring, legal structuring, incentive systems, reflection on practice/projects and scale perception regarding GI. The findings were interpreted within the scope of the GI approach of the countries.

3. FINDINGS and DISCUSSION

Space is shaped and characterized by differences in natural, social, cultural and economic structure and turns into a "place". For this reason, it differs from country to country, from region to region, and from urban to urban. In addition, each urban's acceptance of new approaches or their post-acceptance adaptation is different for this reason. A good example at this point is that the GI system has different perceptions in countries, despite the proven benefits it provides to the city.

The historical background is very effective in countries' GI practices. The USA and the UK were early in implementing the GI system, as they had "applications of open green areas, green roads, new urbanism trends in the urban planning process" since the 19th century. They demonstrate effective examples in every field such as planning, implementation, design, policy, etc. European countries have also adapted quickly to these GI systems. However, in other countries, the process progresses slowly. Today, GI systems are not reflected in the management in some countries, in the legislation in some countries, and practice in some countries. It is a concept used in the scientific world in some countries.

Scientists in the field of spatial planning see GI systems, which are a nature-based or nature-resolution approach, as a powerful planning tool, focusing on combating/adapting against climate change, rainwater management, urban biodiversity protection, and urban disaster management. However, each country's practice and discourse regarding GI is different. Today, developed countries, guided by science, have transferred the GI system to the urban planning process with strong laws and institutional systems (for example USA, UK, EU countries). In countries that are affected by scientific data but cannot put it into practice due to social-cultural-economic conditions, GI is a government recommendation (for example Türkiye). Today, in most countries, GI is the subject of scientific research as a nature-based solution to many problems



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(for example Iran). In short, the difference in the reflection of the GI system in practice is parallel to the development level of the countries and their use of science as a guide.

The perception of scale regarding GI systems varies from country to country. This change in perception also affects institutional structuring and legislation. For example, the USA, the UK and EU countries produce structures and policies that address GI at the basin and urban scale. In countries such as China, Japan, India, Türkiye and Iran, the focus is on the functioning of GI at the urban scale. This may cause GI systems to have different applications in countries.

GI systems are solutions with high initial costs. Therefore, it requires strong incentives (credits, tax deductions, project grants, expedited permits, etc.). Incentives are primarily dependent on the country accepting the GI system as a solution. Then, the economic situation of the country manages the process of promoting environmental/nature-oriented policies. America, the UK, and EU countries have strong and impressive GI incentive programs. Incentives are given to institutions, the private sector and the public. In countries such as Japan, where GI-related practices are gaining importance day by day, incentive programs are expanding. In some countries such as China and India, grants are given to projects in plot areas. In some countries, support is given to only scientific projects related to GI. In short, projects/applications related to GI systems have different incentives from country to country.

Developments regarding GI systems and the social, cultural, economic and political situations of countries are very important. Today, Iran states that it cannot handle studies on GI systems due to its current economic and political situation. The USA, on the other hand, prevents Iran from accessing environmental funds allocated by GEF. In this context, GI is an example of how countries still conduct policies based on "environment/nature".

4. CONCLUSION and RECOMMENDATIONS

The green infrastructure system is the "key component" recommended by today's scientists within the scope of resilient and sustainable urban planning. When the scientific literature is examined, some philosophical discourses can be made regarding green infrastructure. For example, green infrastructure is based on the concept of planning on the basis of the natural processes/system that originates in the city. The green infrastructure system includes the acceptance that the city cannot be planned only in line with human needs, desires and dreams. Green infrastructure adopts the principle that "the city is based on a resource/essence that is too sensitive to be a demonstration of technology." Green infrastructure adopts the motto of planning the natural and man-made, again under the guidance of nature/creation. Today, these discourses are spreading to countries that conduct scientific studies on green infrastructure.

Countries' use of scientific information varies according to their socio-economic, political and cultural structures and their attitudes towards using information as a guide. Even if human life and the common future of the world are in question, the attitude toward using knowledge as a guide does not change easily. However, attitudes can be directed through international policies and collaborations. For these reasons, the world is the scene of different countries, cities, etc., in the same time period / in the light of scientific data. The implementation of green infrastructure systems is a clear example of this situation. Every country creates its cities according to its reality, despite science.

Countries that use scientific data as a guide shape their realities in the light of information. For example, when the countries where green infrastructure systems are implemented are examined,



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some points attract attention. These are (i) GI is projected at different scales (basin, regional, local) (ii) Planning-design requires a participatory approach (public, private institution, public, etc.) (iii) It is guided by laws (iv) It is supported by political discourses (v) It has incentive programs and is supported (vi) It is implemented with pilot projects (vii) Projects are produced by GI experts (landscape architects) and competent technical staff (viii) It has application guides for local governments (ix) Its contributions are investigated through scientific research (x) Gray infrastructure It is recommended to evaluate holistically with blue infrastructure. This situation also causes countries to improve each other in the light of science. It provides collaboration. Collaborations on nature/environment create a system whose impact is becoming stronger.

As a result, green infrastructure systems are an approach that makes significant contributions to the fight-adaptation process against global warming, from urban environmental issues. This impact on cities is a very important force for the common future of the world. Urban green infrastructure systems in all countries in the light of scientific data and material and spiritual global cooperation; It should be included in the urban planning process "at national-regional-local scales, by expert groups, with a participatory approach, technological power, impressive legal infrastructure, long-medium-short term policies, encouraging economic supports, deterrent sanctions". In addition, detailed planning and design guides for local governments should be created and the process should start with pilot applications. Because cities are the most critical areas that determine the present and the world of the future.

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ANALYZING SPATIAL CONFIGURATION IN ÇANKIRI HISTORICAL CITY CENTER

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ABSTRACT

Historical areas are memory spaces that transfer the characteristics of the past to the present. Due to the rising population and urbanization in cities, the accessibility of historical city centers can be negatively affected. The protection and development of the spatial characteristics of historical city centers is important. This research aims to analyze the intelligibility values reflecting the accessibility and spatial characteristics of the streets in the Çankırı Urban Sites. In the research, spatial integration maps were analyzed by using the space syntax method. Visibility graph analysis was utilized on the street texture to examine the intelligibility of the historical city center. As a result, it has been revealed that the streets with socio-cultural uses such as traditional architectural patterns, trade areas, and community centers have a high integration value and are effective in the spatial configuration.

Keywords: Accessibility, Historical Site, Space Syntax, Spatial Analysis, Street Layout.

1. INTRODUCTION

Historical areas contribute to cultural and social life and are shaped by human behavior. Due to rising urbanization in the world, urban spaces are changing in cities. The increase in population in cities causes the morphological structure of the urban areas to change. Understanding the urban texture in the historical city center is important for the development of the city. The correct perception of the cultural, social, and economic layers in historic city centers will facilitate the correct perception of urban identity and the implementation of appropriate projects (Kepenek et al., 2015). The voids in the historical environment are of great importance as open spaces that add meaning to the urban whole with the features they contain (Özkaraca & Halaç, 2021). The gathering places, directions, and movement directions of human communities living in a settlement are determined according to the system formed by the geometry of that settlement (Alemdar & Özbek, 2021). In this context, the spatial characteristics of the street texture that forms the mathematical infrastructure of historical city centers should be analyzed.

A systematic analysis of the spatial characteristics of the building should be made by developing a mathematical model without damaging the traditional values of the historical centers of the planning process (Has, 2022). Space configuration includes sequence in the transition between spaces, succession, change of movement route in transition, presence of alternative transitions, and intersection of transition routes in different directions (Erman, 2017). In this context, the street network, which determines the movement routes in the spatial configuration, has an effective role in the study of cities. According to Hillier and Hanson (1984), spatial configuration features of buildings and settlements can be examined with the space syntax method. The space syntax method, which examines space configurations, is used at many scales, from the building scale to the city scale, in research on spatial features in urban public



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spaces. Space syntax methodology provides tools to analyze the linguistic properties of space, namely configuration, visibility and accessibility, and their functional relationships with the physical, social and spiritual environment (Turner, 2001). This method allows us to analyze open spaces other than architectural structures in historical areas. On the other hand, D'Autilia and Spada (2018) emphasize that spatial organization should be perceived as three-dimensional, not two-dimensional. Therefore, it is important to add the third dimension with visibility analysis, which provides the perception of space in urban areas.

The Urban Site Area located in the city center of Çankırı, which is the case study in research, is a traditional settlement area with its oldest neighborhoods and cultural values. Çankırı is one of the small cities of Türkiye, gives the city its identity with its historical heritage from past to present. The city of Çankırı has a very old history, with human traces dating back to the Paleolithic Period (Çankırı Kültür & Turizm Bakanlığı, 2023). The city, which is home to many civilizations, has preserved historical and cultural values with its registered architectural structures.

The city's original architecture such as monuments, mosques, madrasas reflect the historical texture. The original architecture of the city reflects the historical texture. It is necessary to improve physical accessibility in order to protect the historical city center of Çankırı, where many architectural structures are located, and to increase its functionality without harming its texture. Creating an urban center that keeps the historical texture alive is important in terms of sustainability. The aim of the study is to reveal the integration of the streets in the historical city center and to improve their spatial characteristics. In the study, the places where pedestrian mobility is the majority in the historical city center of Çankırı were analyzed. As a result, it has been determined where cognitive experiences can be developed in the historical city center. The relationship between the spatial organization of the street network and integration values in the historical area was examined. The relationship between Çankırı Urban Sit Area and the city center was examined through the street network that forms the city morphology. The accessibility of the streets in Çankırı historical city center was evaluated using the space syntax method. The study is important to evaluate the results of pedestrian movements in the streets through mathematical analysis and to reveal and improve the places where disconnected relations occur in the historical area. The study also provides ideas to public authorities, urban planners, designers, architects and landscape architects on the development of street texture in the protection of the historical environment and the implementation of this example in small cities.

This study consists of three stages. In the first stage, the values related to the street texture created by spatial integration values were examined. In this context, data from the study area were collected and high or low integration areas of the street texture were revealed using the space syntax method. In the second stage, visibility graph analysis (VGA) was applied to identify perceptible areas in the street texture. In the conclusion part, in line with all the data obtained, axes to increase the usage areas of people in the historical area were evaluated.

2. MATERIAL and METHOD

2.1 Material

Çankırı province is in the northeast of Ankara, the capital of Türkiye, was chosen as the study area. The coordinates where the Çankırı province is located are between 40° 16' N and 41° 04'



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N and 32° 34' E and 34° 08' E. The historical area located in the center of Çankırı province and the surrounding metropolitan area constitutes the main material of the study. An analyzes was made on the current map obtained from Çankırı Belediyesi (2022). The study case was analyzed through fieldwork, observation, satellite photographs, and other data regarding the location. The study area was chosen because it traces back to different periods in the past, is one of the intensively used and highly accessible areas of the city and reflects the original traditional architecture of the city. DepthmapX 0.80 software, literature research, field analyzes and current maps for the application of the space syntax method in the study are other materials of the study. The geographical location of the study area is given in Figure 1.

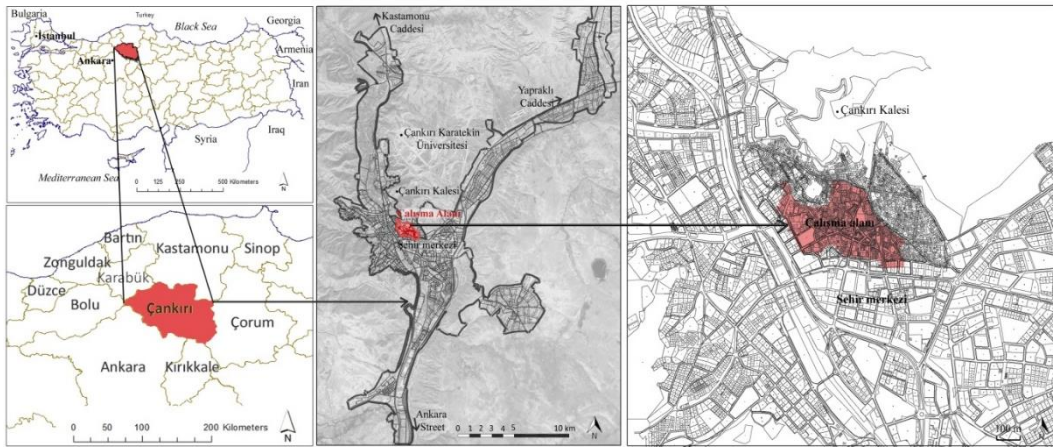


Figure 1. The geographical location of the study area

2.2. Method

The space syntax method was used in the study. Spatial syntax theory is a graph-based theory developed by Hillier and Hanson (1984). Spatial Syntax is a set of techniques supported by theoretical approaches, used to define the spatial models and intra-building space organization of built environments, regions, cities, and building groups at different scales and to examine their interactions with the social structure (Gündoğdu, 2014). Unlike computer-generated designs, the spatial sequence method is also effective in the formation of a spatial structure that acts according to social data by drawing some conclusions based on observations and analyzes. (Özkan Özbek, 2007). Therefore, space syntax helps to understand the user experience and analyze the physical structure of space. With the space syntax method, axes are created on open spaces and spaces are classified according to the places where people are most frequently present in these areas and the places where people are less likely to be present.

Çankırı city street network data was collected in order to perform space syntax analysis in the study area. The intelligibility of space refers to the relationship between its integration and connectivity values (Günaydın & Yücekaya, 2020). In this context, two different values were considered to evaluate the data collected and to examine the street network features. These are connection and integration values. Hillier (2007) explains these values as follows:

1. Connectivity is taken as an indicator to explore the degree of connectivity of a given space with other spaces.
2. Integration relates to the integration of a line into all other lines of the axis map.



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In the first stage of the study, integration maps were obtained through spatial analysis. Spatial integration value was calculated based on the axis maps produced over the street network. The integration value is a number obtained to reach from one axis to another axis and provides information about the accessibility level. Integrated spaces have the potential to bring together all the people who live in a place or are there for any reason (Has, 2022).

In the second phase of the study, Visibility Graph Analysis (VGA) was used for the visibility relationship within the area. VGA is often used to study the visibility relationship between spaces at a semi-urban scale (Turner, 2001). This analysis measures the perceptibility of the public space by examining the area between the street network and the buildings. According to Turner (2003), VGA provides us to understand how people move or interact in visible space. It evaluates how visible urban open spaces are in an area by performing a three-dimensional visibility test. In this context, visibility graph analysis was performed on the gridal system according to the human scale on the street texture of the study area. In this context, visibility graph analysis was performed on the gridal system according to the human scale on the street texture of the study area.

In the last stage of the study, the common results of all the data were evaluated and the streets with high values of movement and perceptible areas were revealed. A general synthesis and evaluation of the data obtained by the two methods used together with the analysis of the field study with the space syntax and wayfinding methods of Çankırı Urban Site Area was made.

3. RESULTS

3.1 Space Syntax Analysis

The historical center located in Çankırı city center is one of the oldest settlements. The study area, which includes the city's protected area, provides different spatial experiences to users. Analyzing the route formed by the street network becomes important in terms of understanding the experiences in the area with its architectural structures. The relationship between buildings and the street network can directly affect people's experiences. With the space syntax method, the spatial configuration of the space along with the user experience was analyzed. The street pattern in the Çankırı Urban Site Area is given in 2a, the axial map created by the topological analysis of the space arrangement based on axial lines is given in Figure 2b, and the integration map is given in Figure 2c.



Figure 2 a. Street pattern b. Axial map c. Integration map

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It is seen that the street network formed by the traditional housing texture within the Çankırı Historical Site is irregular. The urban renovation practices are carried out within the area within the framework of the conservation plan. There are narrow roads and dead-end streets in most places in the area. Integration and connectivity maps for the area are given in Figure 3a and Figure 3b.



Figure 3. a. Connectivity map b. Integration map

The integration value of the area increases in the center and at the intersection of axes. On the other hand, the axes that provide the longest and uninterrupted transportation within the area have high accessibility. Uzunyel Street, Manifaturacılar Street and Vali Ayhan Çevik Street in Çankırı Urban Site Area have the highest integration value. These axes form the main spine of the area and the accessibility level of the streets connected to these axes is relatively high. Streets with high integration value are suitable for developing tourism and bringing people together. The highest integration value in the area is 2.84 and the lowest integration value is 0.72. It is seen that Uzunyel Street has the highest value in the area with an integration value of 4.72. Maximum, minimum and average values for integration and connection maps are given in Table 1.

Table 1. Maximum, minimum and average values of integration and connectivity maps

Values	Minimum	Mean	Maximum	Std. deviation
connectivity	1	8.60377	42	6.74072
integration	0.726546	1.62715	2.84202	0.416166

The correlation graph of connection and integration values, which express the intelligibility of the study area is seen in Figure 4. In general, the intelligibility value given as R^2 is evaluated in three ways: weak, good or strong, R^2 values between 0-0.5 are positioned as weak spatial identifiability, and R^2 locates at 0.5-0.7 which indicates that spatial identifiability is good (Lin et al., 2007). Accordingly, it turns out that the relationship between integration and connection values in the area is good with a value of 0.649.



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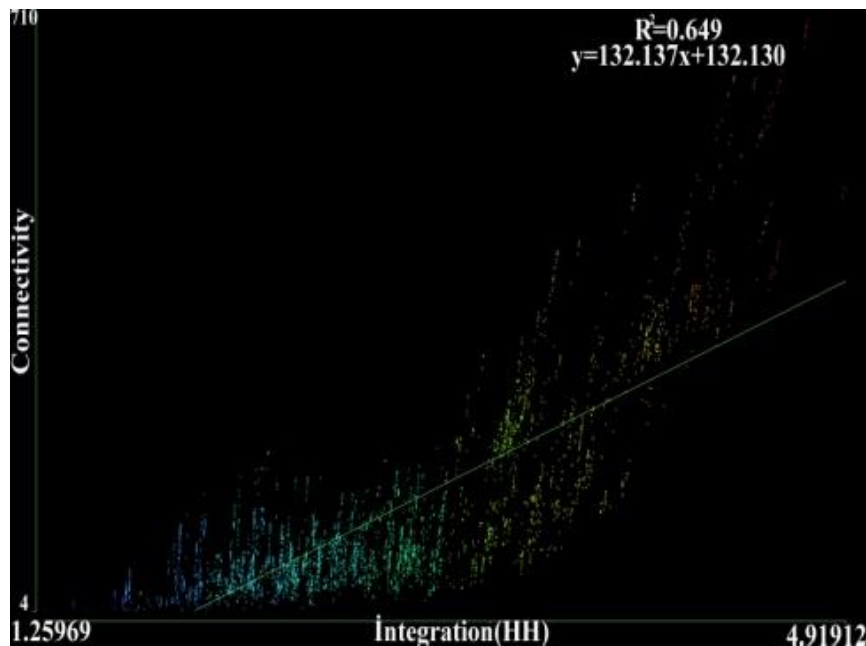


Figure 4. Correlation graph for connection and integration values

Although the accessibility value of the area seems to be high in the center, this value is gradually decreasing in the whole area. Therefore, it becomes clear that the accessibility degree of the area can be improved. Generally, it is seen that the historical region has a complex street texture. Visibility graph analysis was examined to measure the level of perceptibility.

3.2 Visibility Graph Analysis

Streets with historical and cultural characteristics are areas that provide a connection between the city and sociality. When examining historical areas, in addition to spatial organization, the perceptibility of the place should also be taken into account. In this context, visibility graph analysis was applied in the research for the perceptibility status within the street network. Within the scope of VGA model analysis, isovist areas are extracted through pedestrian flow simulation. An isovist is a set of all points in space visible from a given vantage point and relative to a perimeter, and the shape and size of the isovist are liable to vary with location (Benedict, 1979). The visibility graph analysis of the streets in the study area is given in Figure 5.

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Figure 5. Visibility graph analysis of streets in the study area

As a result of the visibility graph analysis, images of the streets with high integration values in the historical area are given in Figure 6.



Figure 6. Streets with high accessibility values in the study area

Uzunyol and Vali Ayhan Çevik Street, which have a high integration value in the area, are the axes on which the traditional housing texture is shaped. The architectural structures located on these axes have been effective in creating an uninterrupted line of the street texture and at the same time increasing the integration value. Manifaturacılar, Bakırcılar and Elif Street are the axes where commercial use is concentrated in the area. It was seen that the commercial areas located on these streets are another factor in the configuration of the streets and the high value of spatial integration. Imaret and Büyük Cami Streets, which are among the streets where mosques function as gathering areas in the historical region, are located, and also have a high integration value. The rise of common-use areas in these axes has increased the integration value.



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4. RESULT

In recent years, due to the change in cities, has caused forms in the social-cultural and physical structures of city centers. Historical areas in city centers are places that may be negatively affected by this change. In this context, there is a need to develop studies aimed at examining the urban texture.

With its registered urban sit area located within the city of Çankırı, it is one of the sample areas that add social and cultural values to the city. To protect this area, the street layout that forms its physical morphology must be analyzed. In this context, the spatial configuration of the streets in the historical region was analyzed in the study. In the analysis, it was revealed that the results of the connection and integration maps that provide the analysis of the intelligibility of the streets are good. Streets with high perceptibility create potential for the development of tourism routes. Mansouri and Ujang (2017) used the space syntax method to determine tourist mobility in their research in the historical Kuala Lumpur region of Malaysia, and as a result of the study, it was revealed that integration with pedestrian movements can be increased with pedestrian-oriented activities along the road rather than the connections of the walking paths. In this context, it is necessary to develop urban designs that will ensure walkability in order to increase the attractiveness of the streets with high perceptibility in the historical city center. On the other hand, Kim and Sohn (2002), using space syntax theory, analyzed the urban street configurations of two areas in terms of their local structures and global contexts with different urban street configurations, and concluded that urban configuration affects the physical formation of cities. Balcı (2017) states that the value of a historical environment or an urban protected area is created not only by registered cultural assets but also by the holistic texture, character and sociocultural structure of these areas. In this context, it becomes clear that cultural tourism routes need to be developed in the area. Sustainability should be ensured throughout the city with these routes, which will be beneficial for urban development.

The structure of the street layout in residential areas is one of the most important factors that provides a sense of place to the space and shapes its design. It has been revealed that the accessibility of perceptible streets in Çankırı city center is also high. The relationships between street network integration and urban fabric provide data on usage experiences. Analyzing urban street textures with space syntax offers a quantitative approach to determining areas where tourism will be developed. As a result, it has been concluded that commercial areas in the historical area, traditional housing texture and common meeting areas shape the spatial configuration of the streets. It was found that the physical formation pattern of the space is affected by the social context. The study provides data to test the proposed methodology and compare it with other studies to examine the spatial characteristics of historical areas. Research findings provide a reference in solving the perception of tourists and improving the experiential qualities of historical streets depending on conservation plans in cities.

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GREEN INFRASTRUCTURE SYSTEMS IN URBAN AREAS THE IMPORTANCE OF SOIL PERMEABILITY

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ABSTRACT

Along with the environmental problems brought about by the Warming Global, it offers different solutions in terms of protecting the natural balance and sustainability of biological resources. Green infrastructure systems are among those that stand out in these solutions. This approach causes not only the natural habitats but also the cultural living environments in the outside areas to be evaluated as a complex structure. In this context, it is of great importance on hard floors, which are part of the green infrastructure structure. It is seen that the precipitation waters flow away before they reach the level due to the increased construction and the amount of hard ground in recent times. Due to climate change, which is one of the leading environmental problems, the importance of water is increasing gradually depending on the time of our water resources. Trees of water within the scope of water management are very important in places such as landscape areas, irrigation waters and hard ground, which constitute a large part of water use, in order not to experience water shortage in the future or to prevent water use. Designing large-scale hard floors as permeable surfaces in urban areas includes evaluating these dimensions. The purpose of the use is to draw attention to how water consumption can be reduced with the dimensions of the permeable surfaces by designing these components properly and to draw attention to the importance of these showcases. The ecological and economic contributions of the permeable surfaces to the city in the regions that are detrimental to the literature structured to achieve this aim have been revealed.

Keywords: Urban Area, Ground Permeability, Water Management, Climate Change.

4. INTRODUCTION

Along with the environmental problems brought about by global warming, different solutions are put forward in terms of preserving the natural balance and sustainability of biological diversity. Green infrastructure systems are one of the prominent solutions. This approach causes the landscape to be evaluated as a complex structure, not only in terms of natural living environments but also in terms of cultural living environments in urban areas. In this context, hard surfaces that are a part of green infrastructure systems are of great importance.

Recently, due to the increasing construction and the amount of hard ground, it has been observed that rainwater flows away before reaching the soil. The importance of water is increasing in these periods when our water resources are decreasing due to climate change,



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which is one of the leading environmental problems. To avoid water scarcity or reduce water consumption in the future, it is very important to store water within the scope of water management in places such as urban landscape areas, irrigation waters and hard ground, which constitute a large part of water consumption.

Hard soils, which cover large areas in urban areas, should be designed as permeable surfaces and should be evaluated in this context. The aim of the study is to draw attention to how water consumption can be reduced by appropriately designing these areas and increasing the amount of permeable surface and to the importance of these areas. In the study conducted for this purpose, the ecological and economic contributions of permeable surfaces in urban areas to the city were revealed, supporting the literature.

As a result of the opening of stream beds and natural basin areas to urbanization, the destruction of natural vegetation and the creation of impermeable surfaces (parking lots, pavements, asphalt roads, etc.), the water cycle is interrupted (Poletto and Tassi, 2012). Especially in dense urbanization areas, the flow rate and speed of water flowing on impermeable surfaces has increased and therefore the ability of water to seep into the subsoil has decreased (Lau and Mah, 2018). Especially in recent years, the increasing number of vehicles has created the need for parking. In this context, there are parking areas with a lot of impermeable surface areas, little green space, and no vegetative design. This situation increases the amount of impermeable surface.

In areas where urbanization is intense, the risk of flood increases as the water passing into the surface flow is quickly directed to streams. Acceleration of water flow in areas with intense urbanization creates floods, drought, poor water quality and negative effects on groundwater resources (University of Arkansas Community Design Center, 2010).

Increasing urbanization causes the flow channels of natural waterways occupied by buildings to change over time, the water mass passing to the surface flow increases, and the infiltration surfaces of the soil decrease. This situation makes settlements where urban development continues and has not been properly planned, vulnerable to floods and floods due to infrastructure systems (Erkal and Topgül, 2020).

Green infrastructure is a green space network consisting of interconnected natural, semi-natural and cultural areas designed and managed to provide ecosystem services, preserving ecosystem values and functions (Nature Conservation Centre, 2019). Unlike gray infrastructure, which uses structural systems, green infrastructure uses vegetation and soil to manage rainwater where it falls. "By integrating natural processes into the urban area, it provides solutions not only to rainwater management but also to problems such as flood reduction and air quality improvement." The basic principle of green infrastructure is the use of vegetative elements to provide ecosystem services (Fletcher et al., 2014). For the use of vegetated areas, the amount of green space should be increased, and impermeable surfaces should be reduced accordingly.

In this study, examinations were made through examples to reveal the importance of ground permeability in green infrastructure systems in urban areas.

Techniques used in the study, include examining publications on the subject (books, theses, reports, articles, congresses, symposiums, seminars, websites, laws, regulations, etc.), revealing the importance of ground permeability in green infrastructure systems within the framework of literature and source research, and evaluations through examples.



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Studies revealing the importance of green infrastructure systems on ground permeability in urban areas were examined. In his study examining surface permeability in city parks, Eşbah (2006) stated that as the rate of permeable surfaces in a park increases, the level of ecological balance will increase and this park will provide more opportunities for biological activity, material and energy exchange. The same researcher showed that when this situation is the opposite, the ecological quality is low and the ecological benefits that such areas can provide to both wildlife and the city are limited.

Tennis et al., (2004) mentioned in their study that permeable floor coverings are important in reducing rainwater runoff and rainwater management.

In their study, Doygun and Kısakürek (2013) emphasized that unnecessary covering of park grounds with hard materials should be avoided, to improve urban parks ecologically. This data underlines the importance of urban parks functioning as green infrastructure in terms of ecological balance and sustainability.

The study by Korkut et al., (2016) reveals that rapid and unhealthy urban development leads to the increase in asphalt, concrete and glass surfaces in cities, resulting in a decrease in green areas and the gradual disappearance of permeable surfaces. This situation threatens underground water resources in urban settlement areas and causes climate change to be felt more effectively in cities. People, who are exposed to increasing population density day by day, face higher temperatures in cities where concrete and impermeable grounds increase and green areas decrease. This situation causes precipitation water to be lost through surface runoff and the urban heat island effect to occur.

In the study conducted by Irmak et al. (2017), it was revealed that grass-covered areas and impermeable surfaces change the temperature in residential areas.

In their study, Shin and Lee (2005) emphasized that urbanization and the transformation of green areas into hard grounds are the main reasons for the increase in surface radiant temperature.

The study of Bayramoğlu et al. (2019) shows that decreases in open green areas lead to changes in both natural cycles and the water cycle in the city. With the change in climate, urban rainwater is not sufficient in traditional water collection systems and the risk of floods and floods due to sudden rains has begun to be encountered. They emphasized that the best solution to this situation is to integrate permeable surfaces into urban systems when making urban design decisions.

Da Silva et al. (2018) emphasized in their study that when rainwater and roads in urban areas were designed as natural areas in Brazil, water accumulation on the surface decreased and water leaked into the soil. However, they stated that they experienced problems in the infrastructure of water drainage in regions with intense urbanization, and with the solution they proposed, the balance could be achieved in sustainable ways by slowing down the flow of rainwater, increasing permeability, and collecting water from surface flow.

In their study, Adigüzel et al. (2022) focus on the various comfort features that the climatic features of cities offer to their inhabitants. However, it emphasizes that today, the increase in building masses and hard/impermeable surfaces (concrete, asphalt, etc.) with high heat storage and conduction capacity leads to temperature increases at local and regional levels. The study states that impermeable areas (roads; hard surfaces: concrete, parquet, asphalt, etc., buildings)



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that prevent water from meeting the soil increase long-wavelength radiation by storing high amounts of heat, and at the same time, high-rise buildings with a shadow-casting effect contribute to the increase in air temperature at night.

Apaydın and Ak (2022) examined the potential of hard flooring to increase the visual impact value in their study. In the study, based on the Psychophysical approach model, which is one of the landscape impact assessment methods, 18 different flooring materials in the photograph were used to evaluate (Concrete, Andesite, Gravel, Basalt, Grass stone, Rubber, Granite, Red Soil, Slate, Interlocking Concrete Paving, Sand, Log Mosaic, Marble, Travertine, Wood, Brick, Asphalt).

- For a natural and harmonious appearance; wood, basalt, travertine, andesite, and grass stone materials,
- For a regular, clear, and perceptible appearance; andesite, basalt, granite, grass stone, travertine, and wood materials,
- For a lively and exciting look; log, grass stone, slate, travertine, gravel, and wood materials,
- For a look that feels safe; andesite, basalt, travertine, wood, and granite materials,
- For a relaxing, peaceful, and calm look; Granite, wood, basalt, and andesite materials
- For an impressive and beautiful appearance; wood, basalt, andesite, slate, grass stone, travertine, and log materials.

These examples represent different applications of permeable hard surfaces. Such surfaces offer significant advantages in terms of water management, environmental protection and sustainability, air quality, aesthetic value, sound insulation and zero liquid waste. Permeable hard surfaces can be used in urban areas, parks, parking lots, bicycle paths, gardens and other areas and are also very important as part of an environmentally friendly sustainable design approach. However, while permeable surfaces have many advantages, they also have some disadvantages that should not be ignored, such as the need for maintenance, durability, installation cost, and risk of leakage.

5. CONCLUSION

- Rapid and unhealthy urban development increases the number of hard surfaces in cities due to concrete, asphalt and glass surfaces, causing a decrease in green areas and ultimately the gradual disappearance of permeable surfaces. This situation threatens underground water resources in urban settlement areas and causes climate change to be much more effective in cities. In cities that are increasingly exposed to more human density, become more concrete, have more impermeable grounds and fewer green areas, sensible temperatures increase, rainwater is lost through surface flows, and the urban heat island effect emerges.
- Rapid urbanization also affects the natural water cycle in cities. Climate change in recent years and the corresponding decrease in open green areas have affected the urban ecosystem. In order for the urban ecosystem to be sustainable, there must be a certain amount of urban open green areas. In this sense, cities are called impermeable with hard ground coverings and permeable surfaces with open green areas. For this reason,



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permeable and impermeable surfaces must be in certain proportions and arrangements in the urban planning system. Creating permeable surfaces in urban areas can be achieved through designs compatible with nature. The most appropriate way to stop the risk of floods in urban areas by stopping the water flowing to the surface due to excessive rainfall is to create green areas using landscape components or to use permeable surface coatings. This situation is created by harmoniously planning urban infrastructure systems and landscape elements as a result of the hydrological cycle. When evaluated in this context, permeable surfaces are provided by using green infrastructure system elements in contemporary sustainable planning approaches.

6. RECOMMENDATIONS

- Care should be taken to ensure that the grounds other than the mandatory hard grounds in the urban fabric are permeable as much as possible for example, impermeable stone, asphalt concrete, etc. on parking lot floors. Instead, stones with grass joints or stepping stones should be preferred.
- The use of surface coatings with low heat absorption on floors should be preferred in terms of both bio-comfort and energy-efficient landscape designs.
- Precautions should be taken to prevent soil layers on permeable surfaces from compaction and moisture loss so that surface waters can infiltrate underground and feed underground water resources.
- Rainwater in the city should be included in the water cycle by creating permeable surfaces, preventing contamination of groundwater by surface runoff from impermeable surfaces.
- Floors that are permeable materials produced with new technology should be given more space in applications.
- To make existing floor coverings permeable, studies should be carried out on improving them using new technology and different methods.
- Appropriate size gratings should be used instead of impermeable surfaces used around trees.
- Permeable surfaces and green areas should be increased in the designs of open parking areas.

At the same time, “holistic” approaches should be considered for the city as a whole. At this point, holistic approaches such as green roads, green infrastructure and green networks should be especially evaluated against structural and functional changes and deteriorations in spots and corridors.

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GREENWAYS PROPOSAL FOR K.T.Ü. KANUNI CAMPUS AND ITS SURROUNDINGS

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ABSTRACT

With the increasing urbanization recently, the pressure on natural resources is increasing. Increasing construction and inaccuracies in land use cause the fragmentation of landscape animals. To eliminate the negative effects of the parts, these areas needed interconnected connections. It has revealed the green road concept made in this direction. Green roads meet recreational needs as well as cultural and ecological continuity in cities. Karadeniz Technical University (KTU) Kanuni Campus and its surroundings were chosen as the study area. KTU Kanuni Campus, which has natural and cultural values for the city of Trabzon, has many ecological and economic contributions to the city in terms of being an inner-city University campus. From time to time, the increasing population density and the dense construction around the campus caused the fragmentation of green food. The fragmented green areas affect urban life protection, ecology and biodiversity negatively. To minimize these negativities and increase the protection of urban life, it is aimed to connect the fragmented green areas of KTU Kanuni Campus and its surroundings and to organize the green road system together with natural areas. To achieve these goals, the study was carried out in three stages: literature review and inventory studies, analysis study, determination of focal points for the green road and determination of the route for the connection. As a result, in this study, suggestions were developed in addition to creating a comprehensive greenway system by determining the most suitable routes in line with greenway planning strategies and goals.

Keywords: KTU, Green Way, Recreation, Planning.

1. INTRODUCTION

Greenways are networks containing linear elements, planned for many different purposes, and compatible with aesthetic, ecological, cultural, recreational or sustainable land use (Ahern, 1995). According to Fabos (1995), it is defined as interconnected corridors of different widths, such as highways and railways. Green roads also protect natural resources, alternative transportation, habitat for plants and animals, etc. They are natural corridors separated to create areas and can be used for many different purposes (Bryant, 2006). Greenways are a unique type of open space planned for multi-purpose purposes. Various definitions have been made regarding this concept. The European Green Roads Association defines green roads as communication roads that are reserved only for non-motorized transportation and improve the quality of life in the surrounding areas (Senes et al., 2017).



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Greenways represent the integrity of linear open spaces planned for recreational, ecological and cultural uses, and they are protected and managed for these purposes. While most of the greenways have recreation or nature protection purposes, some are planned to cover both purposes. Green paths planned for recreation purposes provide opportunities for walking and cycling paths, organized sports areas, and group activities. In addition, green paths that interact with each other provide a rich experience that follows natural corridors as well as historical and cultural objects. These definitions emphasize that greenways represent a multifaceted planning and use approach. Greenways serve as an important tool for nature conservation, for people to participate in recreational activities and to explore cultural heritage. Therefore, green road projects are considered important resources for the environment, health, culture, and welfare of society. Green roads have many functions such as protecting biodiversity, managing water resources, protecting historical, cultural and natural resources, and providing a living environment for plants and animals. In addition to these functions, green roads also contribute to the city in which they are located in many ways (Zengin et al., 2019).

Greenways are used as tools to combat land degradation, fragmentation, urban growth and uncontrolled land use for sustainable landscapes (Ahern, 1995; Little, 1995; Liu et al., 2018; Viles and Rosier, 2001).

- Greenways created with vegetal fences and river edge lines in agricultural areas offer significant environmental benefits in agricultural areas by preventing erosion and surface runoff, ensuring more efficient recycling of nutrients and offering microclimatic advantages. These benefits enable storage by reducing wind speed and contribute to the increase in atmospheric and soil moisture levels (Forman and Godron, 1986).
- Greenways can combine cultural and ecological resources with the ability to create a network that has more potential for use and is more valuable than the sum of its parts, in terms of landscape synergy (Viles and Rosier, 2001).
- The ability to connect urban habitats and the biodiversity associated with these habitats provides opportunities for positive interactions between humans and nature in densely populated cities, as previously emphasized by Ahern (2013) and Bryant (2006) (Gobster, 1995; Chon and Shafer, 2009).
- Green roads, which are used to increase the quality of life of individuals, serve as a basic transportation network for transportation to daily activities such as work, school or shopping, as stated in the study by Keith et al. (2018) (Rovell et al., 2020).
- Greenways can provide healthy environments where individuals can regain well-being experiences and explore and satisfy various active and passive recreational needs and desires (Fabos, 1995).
- Greenways can help provide environmental benefits such as increasing soil strength, contributing to water purification, providing flood control, and improving air quality (Anthony, 2006; Qin, 2012; Liu et al., 2018).
- It can be said that linear forms of recreation, such as walking and cycling, have the potential to fulfill environmental and social functions (Gobster, 1995).
- Areas such as stream corridors, defunct canals, abandoned railways, power lines and road networks are defined as potential greenways (Gobster, 1995).



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- In areas where green roads function as green belts, they contribute to controlling their development, reducing pollution, and improving and protecting the landscape (Viles and Rosier, 2001).
- Green roads also can provide suitable areas for nature education (Viles and Rosier, 2001).

Greenways also function as tools to combat land degradation, fragmentation, urban growth and uncontrolled land use changes for sustainable landscapes (Ahern, 1995; Chen et al., 2017; Zengin et al., 2019; Karaşah, 2020). Green roads such as vegetative fences and river edge lines created in agricultural areas provide prevention of erosion and surface runoff in agricultural areas, increased nutrient recycling, and microclimatic (reducing wind speed, increasing soil moisture, etc.) benefits (Forman and Godron, 1986).

Greenways, industrialization, rapid population growth, etc. are vital concepts in cities that grow and lose their green areas for various reasons. In such cities, they are multifunctional linear green areas that connect different ecological areas to protect the integrity of natural ecological systems and prevent the fragmentation of habitats (Little, 1995; Liu et al., 2018).

In addition, while ensuring the sustainability of important ecological and cultural areas in and around the city, it also offers alternatives to city users in their limited recreational areas. Therefore, it is of great importance in both protecting natural resources and promoting healthy lifestyles (Panneerhelvam et al., 2020). Greenways are not only roads used to get from one point to another but also an environment for activities and experiences (Taylor, 2015; Rovelli et al., 2020).

This study, carried out in this context, aimed to create the proposed green road plan for KTÜ Kanuni Campus and its surroundings, based on the important green areas of the city, recreation areas, tourism and recreation areas, roads, streams, and water surfaces. By including the opportunities offered by natural and cultural resources in the green road plan in a balance of protection and use, it aims to support the green infrastructure system of the city and offers an area for recreational activities to campus and city users.

2. MATERIALS and METHODS

The study area border includes KTÜ Kanuni Campus and its surroundings, located in the Ortahisar district of Trabzon City (Figure 1). In the study, in addition to photographs obtained from field studies, Google Earth satellite images and software such as ArcGIS, AutoCad and Photoshop were used as materials.

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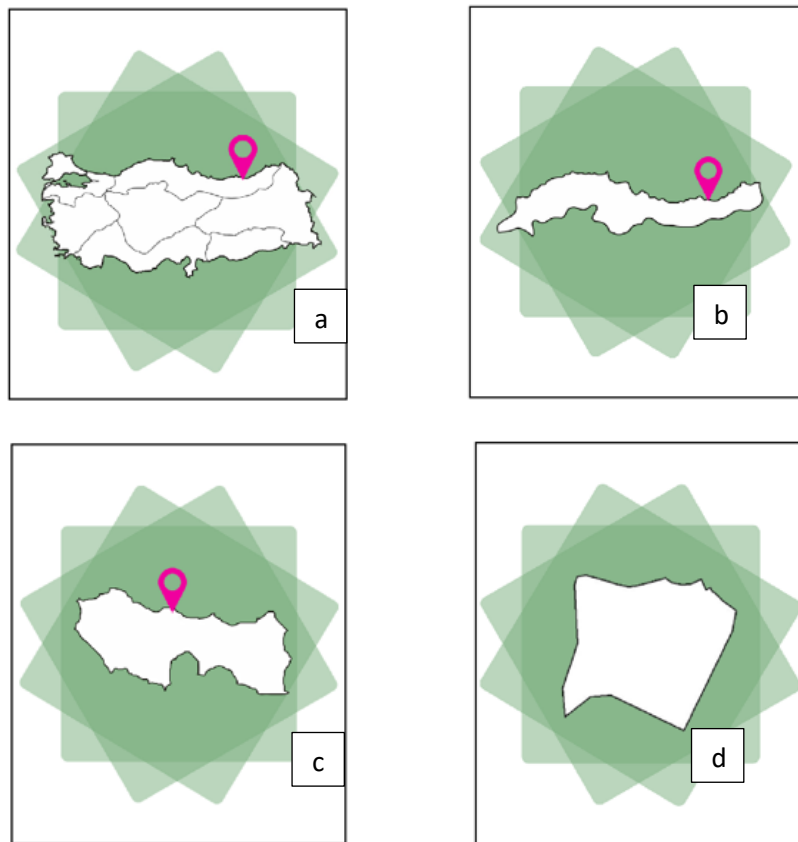


Figure 1. Study area location map (a. Türkiye, b. Black Sea Region, c. Trabzon, d. KTÜ)

The method of the study has three stages. In the first stage, local and foreign literature searches were conducted regarding the green road concept. In the light of research data, the method was decided by making use of studies on green roads. After selecting the most appropriate method for the area, field studies and analysis of the area were carried out. At this stage, research method and GIS techniques were used. In the final stage, area change maps were created through GIS techniques by evaluating the data obtained from literature research and analysis, and focal points and connection points were determined with the help of field studies and Google earth. In the light of this data, potential green road suggestions were developed. While determining the routes, important intersections and median arrangements that ensure the continuity of the green system around the study area, Trabzon coastal road, important focal points that take into account pedestrian and bicycle paths were considered.

3. FINDINGS

In the study, firstly, literature review and field studies were carried out. During the studies, the changes in the natural and cultural elements in the area were detected, and the changes from the establishment of the area to the present day were revealed with images taken from Google Earth (Figure 2) and evaluations were made. As a result of the evaluation, urbanization rates and fragmented green areas were revealed (Table 1), and important focuses and impact zones in the area were determined. To connect fragmented green areas, two different suggested connections have been provided in the area.

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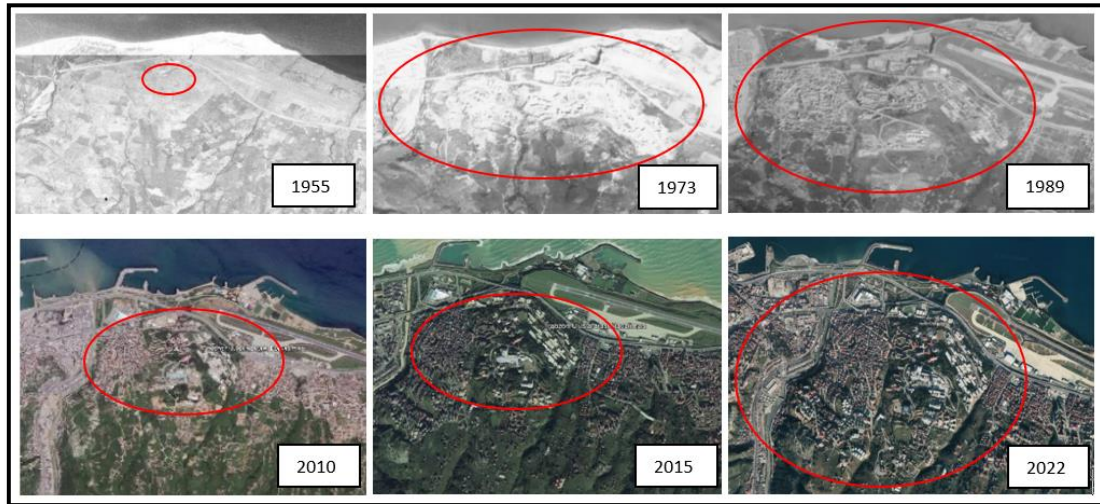


Figure 2. Satellite images of the study area according to years

Table 1. Structural and vegetative changes occurring in KTÜ Kanuni Campus and its surroundings

	1955	2022	CHANGE
GREEN AREAS	247.000 m ²	127.000 m ²	-%48
HARD GROUND	814.118 m ²	934.118 m ²	+% 14,7
RESIDENTIAL AREA	-	709.814,78 m ²	
TRADE AREA	-	83.814,95 m ²	
TRANSPORTATION NETWORK	4.820,84 m	58.556,77 m	+% 1114

The changes in the Kanuni Campus and its surroundings were revealed through Google Earth and the maps created. In the light of this data, it was observed that the green areas in the study area became fragmented (Figure 3).

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Figure 3. Green area fragmentation in KTÜ Kanuni Campus and its surroundings between 1955 and -2022

It was determined that in 1955, the year of establishment of the KTÜ Kanuni Campus, the construction was only within the campus border and there were no buildings around it, the green areas were in one piece and there were generally agricultural areas around it. As the campus began to develop, it was observed that the construction within and around the campus border increased and green areas became fragmented. As a result of the fragmentation and loss of green areas in and around the campus, in order to create integrated planning with its surroundings, parks, squares and roads that are heavily used in and around the campus were identified and a green road proposal was developed to connect these areas (Figure 4). Considering similar areas, the green road system was planned and the necessary connections were strengthened. Many different recreational activities have been defined, such as alternative transportation to these areas with green roads, biodiversity, pedestrian-oriented transportation, viewpoints, recreation areas and bicycle paths.

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Figure 4. Focal points (1. KTÜ Kanuni Campus, 2. Ganita seaside park, 3. Trabzon square park, 4. Trabzon coastal road)

4. CONCLUSION and RECOMMENDATIONS

Nowadays, as the pressures on open spaces in cities and the effects of these pressures become apparent, ecological planning methods and legal measures need to be intensively reviewed. The settlement system must develop to meet the needs of future generations. This can be made possible by preserving ecological balances and not destroying natural resources.

The main purpose of greenway planning is to ensure the protection of natural areas that have been fragmented, lost, or isolated overtime on a metropolitan scale, to establish connections between natural, cultural, and structural environments, to ensure that the public can easily access these areas, and to create suitable areas for different recreations.

When making planning decisions on environmental issues, it is of great importance to examine successfully applied models developed in many cities both in the past and today, to apply these models, and to develop new solutions. Implementation of such applications will be possible as a result of the coordinated efforts of public officials, universities, politicians, private sector organizations, planning-design experts and city users. Adopting and implementing such planning in our country would be the right strategy to reduce the pressure on our natural areas. This strategy is valid not only for urban areas but also for protected areas, rural areas and natural areas connecting cities outside urban areas. Greenway systems will contribute to the protection of these natural, historical, and cultural values and will also enable the use of these values for tourism and recreation. These systems function as an important tool for environmental sustainability and social benefit.

With this study, an attempt was made to ensure integration with the green infrastructure system by considering the balance of protection and use of natural and cultural resources in and around the KTÜ Kanuni Campus, which has an important place for the city of Trabzon. With this study, we tried to contribute to the continuity of the green tissue in the campus and the city, as well as the creation of alternative recreation areas for the campus and city users. Increasing



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environmental pollution in today's cities, insufficient surface flow control and difficulties in accessing green areas are due to lack of planning. Therefore, it is of great importance to integrate greenway plans into planning studies and decision-making processes at all scales.

In the greenway planning proposed for the campus and its surroundings, it is proposed to plan a greenway with an area of 5.5 km (8 km afforestation area on both sides) starting from the main line of the campus and extending to the long street. Considering that 800 trees are planted at 10 m intervals in the green areas planned to be created within the scope of the green road, approximately 310,550 \$ of carbon storage gain is achieved (Figure 5).



Figure 5. Greenway planning proposal 1

- The 2nd alternative way for greenway planning could be a greenway planning starting from the main line of the campus and extending from the beach to Ganita Park. On this line, an ecological bridge can be planned to pass from Gate A to the beach, and then continue as a green road. This could be a transportation line that includes approximately 4 km of green road and 500 m of ecological bridge. In the green area calculation made in this context, $4 \text{ km} * 2.40 = 9600 \text{ m}^2 + 500 * 2.40 = 1200 \text{ m}^2 = 10$. It has been determined that a green area will be added to the 800 m² campus. Although this amount of green space has been increased, the amount of green space on the campus does not reach the standards. The amount of green space required for green areas to be 10 m² per person is 233,000 m². In short, considering that a 2.4 m wide road was built to have sufficient green space per person, it covers approximately 97 km (Figure 6).

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Figure 6. Greenway planning proposal 2

- Appropriate plant species should be selected along the greenway to increase biodiversity and ensure the continuity of nature. In this way, users will move away from the impact of the dense hard ground and get closer to nature, and the sustainability and ecological value of the area will be increased.
- With ecological greenway design, a pedestrian-priority transportation axis that includes alternative transportation systems can be provided. Thus, the carbon and heat island effect can be reduced in and around the campus.
- Planting should be done by the ecological conditions and physical structure of the region, and plant areas that are representative or need to be protected should be excluded.

In this study, the routes recommended to be planned as green roads are; It aims to provide various ecosystem services to campus and city users by integrating fragmented green areas for the campus and its surroundings.

As a result, by correctly planning such routes, the destruction of natural areas will decrease and qualified green areas will be created. In this context, by planning green roads, ecological and economic contributions to the city will be provided by offering recreational opportunities to users and at the same time preserving landscape values (natural and/or cultural). The importance of green roads is revealed by the formation of such qualified areas.

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PHENOMENOLOGY OF THE PALESTINIAN VILLAGE DWELLING

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ABSTRACT

Palestinian villages were one of the arenas severely affected by the British occupation in 1918 and then the establishment of the State of Israel in 1948. The brutal occupation has been destroying villages and displacing their people to control Palestinian territories. Hundreds of villages were destroyed, and their people were expelled. Consequently, many architectural and urban records of Palestinian history and its of cultural, political, and social aspects were lost. But the worst also occurred with the separation between the Palestinians on both sides of Israel borders since 1948. Generations outside the borders grew up on what remained of the memories of their fathers and grandfathers and the images of the Palestinian villages and their houses. Palestinian students of architecture lost the ability to interact with these spaces and structures necessary for the development clear understanding of Palestinian architecture. This research presents an effort attempted by the author to use the phenomenological approach to connect students of architecture at the Islamic University of Gaza to Palestinian architecture. An important part of the exercise was directed to village dwellings remained in Israel after 1948. The phenomenological approach proved useful in helping the students understand Palestinian architecture from the available digital images and photographs available for the village dwellings. The students used their phenomenological cognition to produce architectural drawings for these dwellings which continue to represent a useful source on Palestinian architecture.

Keywords: Palestine, Village, Architecture, Phenomenology.

1. INTRODUCTION

Historical architecture is considered one of the most important and authentic records of the history of societies and their cultural, economic, social, and political movements (UK Archive, 2023). This is because it is one of the greatest records of human settlement on earth, the longest in time, and the most surviving evidence throughout the ages. Vernacular architecture is distinguished from the architecture of the elite. It is widespread in place and has the deepest influence on the people because it houses most of them (Arome and Çagnan 2021). It is the most faithful in expressing the conditions of societies because it was built by the people for the people to provide shelter and refuge. In contrast to the architecture of the elite, which is built by distinct members of society to express themselves and their political, economic, social, and cultural powers. It also often expresses luxury, extravagance, and corruption (Hnin, 2022). In many cases, it is unjustly built from people's money, but not for their sake. In other cases, it expresses authoritarian power for the purpose of dominating society and controlling its capabilities.



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In Palestine, the village was and still is one of the important and influential Palestinian spaces in history. It was and still is in modern history a wide arena for the hidden and declared conflict over the Palestinian land since the beginning of the Zionist project and the British Mandate (Al-Ju'beh, 2008).

One of the most prominent features of the Palestinian village is its distinctive urban texture (Carabelli, 2019). The placement of villages in their places depended on the nature around them, as they merged into the geography of the place and its history in a unique organic manner. The elements of the village structure were distributed in harmony with the natural environment and the social and cultural settings. As for its architecture, it represented the truthful and pure expression of Palestinian culture, its artistic formations, its visual compositions, and the skill and creativity in the use of building materials and construction techniques (Al-Ju'beh, N. 2008).

On the other hand, the Palestinian village was one of the arenas severely affected by the British occupation in 1918 and then the establishment of the State of Israel in 1948 (Ginat, 2018). The villages and their land were the largest area of Palestine, and therefore controlling the villages and their land represented an important goal to control the country. Occupation brutal powers have been destroying villages and displacing their people to achieve this goal. Hundreds of villages were destroyed, and their people were expelled. Consequently, many architectural and urban records of Palestinian history and its cultural, political, and social aspects were erased.

Not only that, but the worst also occurred with the separation between the Palestinians on both sides of Israel's borders in 1948. Generations grew up on what remained of the memories of their fathers and grandfathers. Many efforts were directed to write down these memories in books, stories, anecdotes, and poems. Yet, on the other hand, these generations lost the experience of real living coexistence with urban spaces and the architectural structures of those lost lands. Consequently, Palestinian students of architecture lost the ability to interact with these spaces and structures necessary for the development of urban and architectural creativity and the associated patterns of Palestinian culture and history. Those who grew up in Gaza Strip after 1948 were less fortunate than those of the West Bank. Gaza Strip, since World War I, has been suffering from economic and political problems that affected various cultural and social aspects, including patterns of urban development and architectural formation. This situation worsened after 1948 and continued after 1967. The urban and architectural separation left its traces on the artistic and cultural conscience of those generations over the years without any attention being paid to the need to address this situation, nor to the appropriate methods for such treatment. In 1993, the Department of Architectural Engineering was established at the Islamic University of Gaza, which started to contribute, albeit in a limited way, to building the urban and architectural awareness of the new generations of architecture students. However, the study plan of the department did not include a specialized course in Palestinian architecture to provide an integrated systematic study to build students' self-awareness of Palestinian architecture and its characteristics. This remained the case until 2007, I was the first to suggest to the department that such a course should be offered due to its great importance and because the architecture department in any Palestinian university should seriously be committed to offering this course with this name. The head of the department at the time, Dr. Farid Al-Qeeq welcomed the proposal and insisted that I should teach the course. It was quite a challenge. Not only in determining the study material for the course but also because most of the students did not Gaza Strip and their urban and architectural experience of the Palestinian architecture remained confined to refugee camps and overcrowded cities that lacked the standards of good



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urbanization. They did not have the opportunity to live with any model of historical Palestinian architecture, except the few old houses that still exist in the old city of Gaza and very few remain in other cities. It is true that the study of history, including the history of urbanization and architecture, is usually done theoretically by studying the available written sources, but because human awareness is restricted to the spatiotemporal frameworks drawn by the elements of urbanization and architectural formations, the spatiotemporal coexistence of architecture is considered one of the most important tributaries of its awareness and understanding. This was not available, but there was a unique opportunity to apply a distinguished experience to compensate for this deficiency through the phenomenological approach in architecture, which I also was the first to teach in 2006 in the same department as a separate course. Within this very special context of students of architecture at the Islamic University of Gaza and their study of the Palestinian architecture of the occupied villages, the phenomenological approach provides a unique opportunity to explain Palestinian architecture to the students from one side, and the other side to understand the reactions of the students towards this architecture. Through several years, many dwellings were studied in tens of villages in 1948-occupied Palestine and 1967-occupied Palestine. The concern mainly was directed to the districts of Jerusalem and Al Khalil (Hebron) and Gaza City and its environs. This article studies 11 villages in the Jerusalem district.

Phenomenology

Giving a specific definition for phenomenology is a challenge especially if it is to be directed to people outside the circle of philosophy. Phenomenology appeared as an intellectual movement in the early twentieth century by the philosopher Edmund Husserl, and then by his student Martin Heidegger. Then it became one of the important trends in looking at, studying, and analyzing phenomena of the world. Husserl believed that phenomenology is a subjective process that depends on perception. Awareness is the basis of perception and self-realization requires the existence of the phenomenon in front of it. Husserl used the term world of life to refer to the world of self-interdependence that precedes our theoretical experience of natural phenomena. At the same time, Husserl believes that objective, empirical, natural experience is nothing but the product of human factors and their related aspects of culture and society. Accordingly, the phenomenological approach moves away from the rigid rules of the experimental approach. It relies on the researcher himself who records his impressions of the phenomenon and how he experiences it in the reality of the life world without any hypotheses about the phenomenon. This highlights the importance of the relationship between the researcher and the phenomenon. Thus, the outcome of the phenomenological approach will be narrative analytical studies and not the conclusions of objective tests. (Teodosio, 2005).

The phenomenological approach uses sensational perception to explore the phenomena and their relationships with the people and then tries to understand the sensational reactions of these people (Maveety, 2008).

On the contrary, Heidegger looked at phenomenology as a method of perception that does not require the presence of the self in front of the phenomenon. He describes phenomenology as the way to allow what shows itself to be seen through itself. For him, phenomenology is not primarily about the phenomena that we want to study, but rather about the way in which we study these phenomena. Phenomenology is a method for exploring the hidden sides of these phenomena and making them manifest themselves. In this regard, Heidegger believed that man



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is distinguished from other species because of his spatial relationships with his world. This world, according to Heidegger, is divided into material phenomena and non-material phenomena. Material phenomena include original natural phenomena such as the sun, moon, earth, and sky in addition to man-made phenomena, such as buildings, roads, and squares. Non-material phenomena also include feelings, sensations, habits, traditions, ideals, and principles. Heidegger considered that this world existed before man. Then his struggle started for the making of place and the creation of space and integrating them with the physical and human environments. These places and spaces represented the world of daily life in which he grew and developed. (Gonabadi et al, 2020).

The philosophy of Modernism did not prove viable for explaining the phenomena of life, especially those that are connected to people and are related to their social and cultural aspects. As such, architecture cannot be understood only through the material components. Because there is always more than that, people who make this architecture and those who use it, all have their personal, communal, social, cultural, and psychological characteristics. For such kind of complex relationships, phenomenology provides a suitable approach for its study, analysis and understanding. This approach rejects the adoption of natural sciences as the sole means for the development of human knowledge. It relies on reflective and intuitive thinking that does not depend on any prior assumptions to develop knowledge. The phenomenological approach is not empirical. Phenomenological knowledge cannot be obtained through experimentation and objective analysis, as there are always subjective human aspects that have an impact on guiding knowledge development. Phenomenology is a descriptive cognitive approach that deals with the phenomena of existence through study and analysis to reach the hidden secrets and meanings that surround them. The phenomenological approach is one of the descriptive analytical research methods that aims to explore the secrets of the hidden phenomenon and its hidden meanings and implications.

Phenomenology and architecture

The history of architecture cannot be confined only to the history of building materials and methods of construction, but it is the history of ideas produced by society and culture. Every society has its own culture that distinguishes it from others. (Ehrett, 2023). The post-modern and post-positive period usually looks at the products of architecture and the built environment in general with its functional components and structural calculations. While the phenomenological approach searches in these products for the meanings and ideas that guided man during their production. This is evident in Husserl's saying that awareness of the world is not merely passive acceptance of what is in it but is active and intentional participation in the formation of what is in it. This is exactly what applies to studies of architecture, which should not limit architectural creativity to the means and materials of producing the built form but must include the human interactions that contributed to its production (Teodosio, 2005).

The Phenomenological approach reveals the spirit of the phenomena. Through this approach, we better understand the sensory perception of architecture and the built environment, or in other words, the sense of architectural space and the sense of architectural place. Both space and place have expressions, symbols, meanings, and secrets formulated by the culture and social structures of their makers. (Maveety, 2008).

The spirit of architectural space and the spirit of the urban place express themselves in the world of existence through their spatial components of floors, walls, roofs, and materials with their



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colors and textures. They also have the natural aspects that interact with them such as shadow, light, darkness, heat, cold, humidity and air. (Maveety, 2008).. All these elements and aspects refer precisely and specifically to the content, concept, and rhythm of the world of daily life, which people usually do not pay attention to, nor to its details. This world cannot be imagined without the human being in it. (Simon, 2000).

Phenomenology of the dwelling and sense of place

The dwelling represents an objective existential phenomenon of our life world. Heidegger was the first to introduce the philosophy of dwelling into phenomenology. He linked the existential nature of the dwelling to the life world or the world of daily life. The phenomenon of the dwelling has existential reality which all people perceive in the same way. It has architectural realities that people differ in their perception because of the differences in their emotional and sensational contents. And because of the many meanings and ideas that are reflected by them. This is in addition to the specialties of human subjective frameworks such as culture, society, and politics.

Man has been associated with the dwelling since the dawn of history, from the day he came out of the cave and looked for a place in the space that extended before him. He began making the place of the dwelling by choosing a specific location of land to be suitable for establishing the new shelter. This choice and preparation were not merely mechanical or environmental though it had these characteristics. It was the sense of place that led to the decisions of where and how to delineate this place. The search for meanings responded to what he wanted to see and learn and what he wanted to know and explore. There also were the feelings and emotions for making the place to be loved, looking good, and seemed viable. This initial stage was then followed by the creation of the architectural space of the dwelling. He built his first primitive structure not only as a shelter. He didn't just come out of the cave to make a shelter. Shelter, refuge, and protection were probably more fulfilled in the cave than in the hut. But he wanted to express his being in this world. He wanted to go out into the vast emptiness of space and interact with it responding to the interactions of feelings and emotions in his heart, and thoughts and visions in his mind. From here, the dwelling and its organic connection to man was created. It is not possible to look at the emergence of architecture without a careful understanding of this relationship before looking at its material components (Maveety, 2008).

As an example, the round houses of Britain which are dated from the Bronze Age throughout the Iron Age illustrate this reflection of dwelling. This dwelling reflected the very primitive existential perception of the round horizon around the sight of the human.

The dwelling represents the most important type of human interaction with the environment and the life world. It is the basic form of being in the world as invented by Heidegger. Despite the many studies that dealt with the dwelling from its cultural, social, psychological, and engineering aspects, few dealt with the basic philosophy of the establishment of the dwelling and the symbols and meanings associated with each dwelling that distinguish it from the other. Among the many approaches that dealt with this subject, the phenomenological approach stands out in its ability to explore what is behind the physical structure of the dwelling in terms of these meanings and indications.

According to Heidegger, the dwelling establishes the relationship between the cosmological world, the anthropological man, and the structure of the dwelling. This relationship includes



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various transformations in man's relationship with the world of the dwelling: from existence to presence, from presence to settlement, from settlement to place, from place to dwelling, and from dwelling to place. Christian Norberg-Schulze is considered one of the best in the study of analgesic phenomenology.

In his book: *The Present - Language - Place* (2009), he showed that limiting the dwelling to the quantities of materials used in its construction is limiting its value to the mere walls, ceilings, and floors that make it up, emptying it of the spirit of place, and the absence of the meaning of being. (Gonabadi et al, 2020).

Edward Ralph believes in his book *Place and Nowhere* (1976) that a dwelling loses its meaning if it cannot have a sense of place in the location in which it originates. (Gonabadi et al, 2020)

Regarding the Palestinian village dwelling, it is a special representation of the phenomenological meaning of dwelling. It shows how the architecture of the dwelling evolved from the human consciousness of architecture in a compatible way with his existential meaning he found himself adopting it by nature. The Palestinian villager built his dwelling from his perception of his relation to his land. He wanted to feel a deep sense of place by taking care of his land in a meditative way to make himself an existential part of the safety and belonging found in the basic relation of humans and land.

Key approaches in phenomenological research

Phenomenological research has special concerns on the suitable ways for dealing with the phenomena of the lived world and the world of everyday life. The special connections between the phenomena, people, and the researcher require suitable frameworks of inquiry that are sensitive to issues like subjectivity and prejudice. Yüksel and Soner (2015) introduced 6 approaches to phenomenological inquiry. They include Lived Experience, Intentionality, Epoché, Phenomenological Reduction, Imaginative Variation, and Co-researchers (Yüksel, 2015).

This research used 2 approaches. The first was the lived experience approach. The students were for the first time subjected to the Palestinian traditional village dwellings and their distinguished architecture. This approach investigates the lived experience of students with the phenomenon of the Palestinian village dwelling. It is their first time and first-hand experience of the phenomenon and their actions and reactions, activities, and behaviors were observed. The second approach was Imaginative Variation.

The students were trained to use their imagination to produce their pure original designs for the dwellings concentrating on the relationship between it and the surroundings to express the sense of space of the dwelling. At the same time, we examined the 3Ds of the dwellings produced by the students and used our imagination to assess their perception of the sense of place of the dwellings.

2. MATERIALS and METHODS

The course Palestinian Architecture was given to 2 separate groups of male and female students according to the education system at the Islamic University of Gaza. 18 female students worked in the villages of Jerusalem district. The villages were chosen randomly from the list of the district villages. None of the students has ever visited any of the villages or any other similar villages in Palestine. The main source for photos of villages in 1948-occupied Palestine was the



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website [Palestineremembered.com](https://palestineremembered.com/)- <https://palestineremembered.com/> . The main source for photos of villages in 1967-occupied Jerusalem was the website of Riwaq - Centre for architectural conservation- <https://www.riwaq.org/home> , and its registry of historic buildings, <https://www.riwaq.org/riwaq-register/registry-historic-buildings> . Students also were free to search for information on these villages and their dwelling architecture from any other resources. Their task was to experience the architecture of the village and to prepare plans, sections, and elevations of at least 2 examples of dwellings based on the photos of the village. Special attention was paid to the production of 3D images of the dwellings. They were free to choose any available means of visual presentation. Discussion, presentations, and narratives continued for the whole semester.

3. FINDINGS and DISCUSSION

The exercise was very exciting. When Palestinians talk about their history, country, land, and architecture they feel great stimulation. The students were raised under occupation and their lived experiences were occupied with brutal aggression. Their life world did not exceed the tiny area of Gaza region of 360 km² sieged from two sides by Israel, from the south by Egypt, and from the west by sea. The exercise gave them a chance to have a new lived experience in the classroom with the virtual architecture of the Palestinian village. It was a tough struggle for me and them. I studied, worked, and lived in the West Bank and visited Jerusalem and its environs several times. I also visited several Palestinian cities and villages in Israel. Yet these young students never did. They struggled very hard to be immersed in the life world of the Palestinian village to understand the atmosphere of its urban structure and architectural detail. How could they have a lived experience in an imagined built environment? How could they feel the sense of place of imagined places? How could they feel the sense of architecture without being immersed in its space?

The following discussion of the students' work sheds more light on these questions.

The images of Sataf village (table 1) used by the student clearly show a strong relationship between the dwellings and the village atmosphere. They show the organic relationship between the dwelling and the context. Students were free to use any means of visual presentation for their dwellings. This one (and all the others as will be shown later) used SketchUP software. The 3Ds were bare and bold volumes of the dwelling without any sense of life or significance or relationship with context. The type of figures, trees and grass are not Palestinian. They even lack the sense of nostalgia, the sense of pride, or the storytelling of any life feature of the village dwelling.



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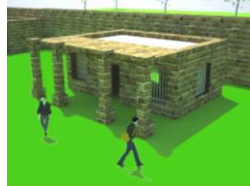
Table 1. Reconstruction of Palestinian Dwelling in Sataf Village

Sataf village (1948-occupied Jerusalem)- General images of the village



Images of inspiring houses and remains

3Ds of students' imaginations of the houses



Although the Deir Yasin village photos (Table 2) show several elements that represent the richness of lived experience in the spaces of the dwellings and between them in this village, students represent the dwellings as separated units without the richness of the original photos. The plants used in the context are not the same in the images of the village.

It is worth mentioning that this village specifically is linked to a massacre in 1948 that lived with despair and grief in the memory of every Palestinian.



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Table 2. Reconstruction of Palestinian Dwelling in Deir Yasin Village

Deir Yasin village (1948-occupied Jerusalem)- General images of the village



3Ds of students' imaginations of the houses



It is noticed that Lifta village (Table 3) has a unique sense of place which put it on the list of UNESCO's tentative World Heritage Sites. It has many inspiring house compositions. On the other hand, when students re-imagine the sense of place here, they cannot reflect the sense of natural landscape that surrounds the dwellings. However, this result emphasizes the effect of the forced displacement of the ancestors of the students from their original land.

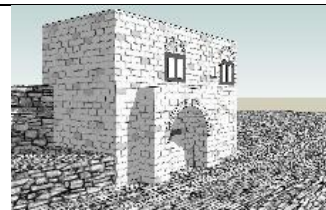
Table 3. Reconstruction of Palestinian Dwelling in Lifta Village

Lifta village (1948-occupied Jerusalem)- General images of the village



Images of inspiring houses and remains

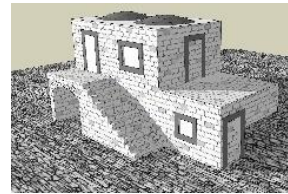
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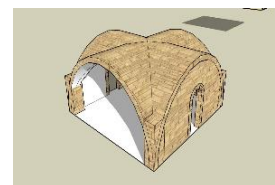
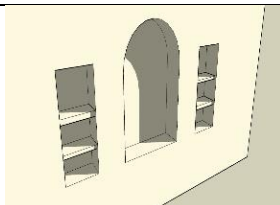
Nataf village images (Table 4) raise the notion of internal space cognition and its relation to the outer original space in the Palestinian village. The construction system used, the raw building materials, and the other elements distinguished the Palestinian dwelling was remodeled by the students in their try to experience the sense of living inside the village dwelling. It is noticed that they reflect the elements they noticed in the images, but they still cannot connect it to the overall sense of place that represents the unique duality of indoor-outdoor spaces in the Palestinian village.

Table 4. Reconstruction of Palestinian Dwelling in Nataf Village.

Nataf village (1948-occupied Jerusalem)- General images of the village



3Ds of students' imaginations of the houses



The general photos of Ain Karem (Table 5) village show that the village's full perception is inherited in its natural intricate components of hills, trees, rocks, and dwellings.

The students who work here show their perception of the dwelling as perceived from the monochrome image. The student did not reflect his sense of the material of this dwelling.



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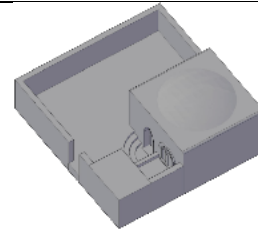
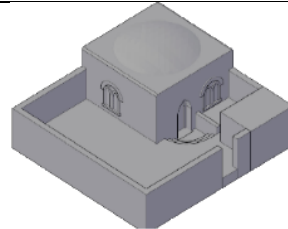
Table 5. Reconstruction of Palestinian dwelling in Ain Karem village.

Ain Karem village (1948-occupied Jerusalem)- **General images of the village**



Images of inspiring houses and remains

3Ds of students' imaginations of the houses

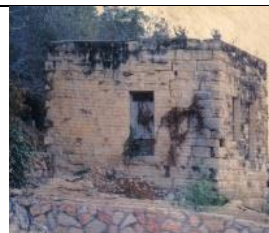


The images of Beit Mahsir (Table 6) inspiring houses show how these two houses are rich with Palestinian dwelling elements. Here, the student reflected on the details in his imagination of the house. However, it is noticed that they could not catch the full perception of the context of the Palestinian dwelling in the village. This is due to the altered sense of place that is caused by the occupation and the dramatic disconnection it made in the whole Palestinian life-world experience from that time till now.

Table 6. Reconstruction of Palestinian dwelling in Beit Mahsir village.

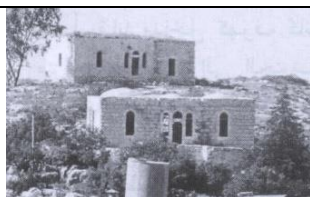
Beit Mahsir village (1948-occupied Jerusalem)-

General images of the village



Images of inspiring houses and remains

3Ds of students' imaginations of the houses





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The cubic form of the inspiring remaining house of Deir Aban (Table 7) village was illustrated by the student via a 3D program with different proportions for the door and window. It was represented as an isolated structure away from its context.

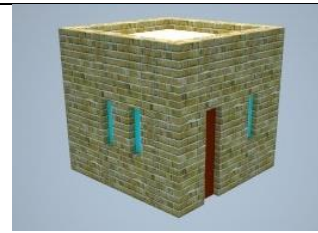
Table 7. Reconstruction of Palestinian dwelling in Deir Aban Village.

Deir Aban village (1948-occupied Jerusalem)- General images of the Village



Images of inspiring houses and remains

3Ds of students' imaginations of the houses



Al-Qubeiba village (Table 8) inspiring houses seem to be more detailed and spacious than the previous villages. It is noticed that the student added a perception of the contemporary materials to feel time continuity for this house as it is still inhabited by its owners.

Table 8. Reconstruction of Palestinian Dwelling in Al-Qubeiba Village.

Al-Qubeiba village (1967--occupied Jerusalem)- General images of the village



Images of inspiring houses and remains

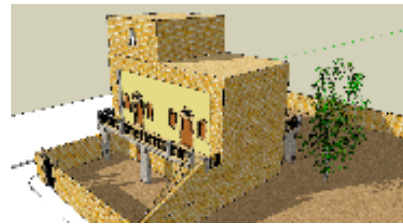
3Ds of students' imaginations of the houses





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The images of Abu Dis village (Table 9) show clearly that the built environment of this village tends to be more transitioning towards civilization in that period (1967). The student perceived the sense of place of the inspiring house of this village in a similar way he perceived her contemporary built environment, so it is noticed that she added a wall in front of the doors of the house as a representation of property boundaries that used to be in civilian spaces.

Table 9. Reconstruction of Palestinian dwelling in Abu Dis Village.

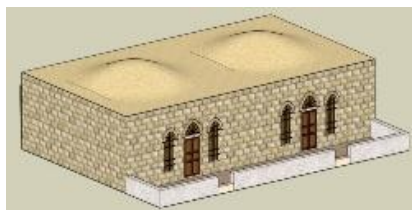
Abu Dis village (1967--occupied Jerusalem)- **General images of the village**

3



Images of inspiring houses and remains

3Ds of students' imaginations of the houses



Nabi Samwil village (Table 10) shows the raised natural landscape of the village's terrains. The inspiring house shows a palace with several spaces and two stories. The student illustrated this unique architectural composition with its natural material and completed the living experience in this house by adding developed elements such as stairs and ironworks. However, the student also could not catch the full sense of place with its natural context.



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Table 10. Reconstruction of Palestinian dwelling in Nabi Samwil Village.

Nabi Samwil village (1967--occupied Jerusalem)- General images of the village



Images of inspiring houses and remains

3Ds of students' imaginations of the houses



4. CONCLUSION and RECOMMENDATIONS

It is concluded that even if the Palestinian students lost the ability to interact with their existential context where their real architecture emerged and developed, the phenomenological approach and cognition helped students catch some aspects of the villages and their dwellings.

Although it is noticed that the students could not represent the organic sense of place of natural landscape fully, it is considered very valuable to expose the students to such experience to build the conception of their architecture gradually.

In addition, The Palestinian sense of place and belonging is harmfully affected by the occupation. The ancestors belonging to the land feeling was altered in a dramatic way which affected the sense of being and the everyday lifeworld.

Furthermore, although the largest number of Palestinians are descendants of villagers, it is noticed that the new generation, including architecture students, have difficulties in simulation and living the lifeworld and experience of village life which is, in essence, the very original existential connection of the human to the earth.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Note on Authors' Contribution

Dr. Abdurrahman Mohamed contributed 70% of the work and Architect Nesma El Saqqa contributed 30% of the work.

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WALKABILITY IN URBAN DESIGN: THE CASE OF BURDUR-İSTASYON STREET

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ABSTRACT

The concept of walkability revolves around the human experience within urban environments. It encompasses not just the presence of individuals on the streets but also their capacity to meet all their needs within a walking radius. The sprawling nature of cities, social and spatial segregation, reduced mobility, and environmental imbalances are among the challenges that non-walkable cities present. Addressing these issues, walkability strives to enhance the urban way of life by fostering a closer connection between people and their surroundings. The walkability of urban spaces stands as a pivotal concept for shaping habitable communities and fostering sustainable urban layouts, all attainable within a short walking distance. This study seeks to assess the quality of walkability in urban areas by considering specific walkability criteria. In this context, the research area chosen is Istasyon Street, a bustling thoroughfare in the heart of Burdur city, frequently utilized throughout the day. The walkability of Istasyon Street was meticulously scrutinized and evaluated based on predefined criteria such as scale, population density, accessibility, diversity, street quality, safety, and comfort. Drawing from the results, we've developed recommendations aimed at enhancing the walkability standards in Burdur's urban planning and design.

Keywords: Pedestrian, Walkability, Walkability Principles, Urban Design, Burdur.

1. INTRODUCTION

The 20th century stands out as the era in which human mobility was significantly amplified by the inventions of vehicles, fundamentally altering the way people move. The presence of automobiles has not only influenced the lifestyles of individuals but has also emerged as a transformative force, reshaping cities. This urban transformation relinquished control of streets to automobiles, resulting in streets being referred to as "roads." While under the dominion of automobiles, streets became hazardous for pedestrians, and city squares and open spaces transformed into parking lots (Ertuğrul, 2019).

The surge in mobility, primarily driven by motorized vehicles, gave birth to satellite cities on the outskirts of urban centers. These satellite cities that sprouted on the fringes of urban areas led to urban sprawl and expansion. In this process, city centers were perceived as business districts, while the satellite cities that flourished with the construction of highways were seen as residential areas (Ertuğrul, 2019). This phenomenon has accelerated the urbanization process, causing a decline in pedestrian movement, and, in some cases, its extinction. However, the emergence of vast expanses of asphalted open spaces allocated to roads and parking has resulted in environmental pollution, social and urban segregation, as well as health risks, among other perils (Rezaei, 2022). This underlines the necessity of embracing, once again, the urban lifestyle that was originally designed and planned within walking distance in the preceding century for the efficient utilization of urban space and areas.



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The concept of sustainable urbanization has brought about the idea of "livability" as an extension of urban quality of life, and livable cities have ushered in new urban paradigms (Gündoğdu & Dinçer, 2020). The concept of a "walkable city" is one of the fundamental principles of contemporary urban and transportation planning. A walkable city is one that has been designed or adapted to incorporate walkability into its urban structure, offering walking as a daily transportation option (Karımı, 2022).

One of the most significant tools that humans use to integrate with their environment is their ability to move. Through the act of moving within a space, individuals sequentially grasp and synthesize values related to their surroundings (Yazıcıoğlu Halu, 2010). One of the most fundamental activities people engage in to comprehend urban spaces is walking. Movement and accessibility within urban spaces are primarily achieved through the act of walking. In addition to serving as a means of transportation, walking also acts as a conduit for establishing an individual's connection with the city (Özalp, 2016). Those who do not walk within the built environment in which they live become detached from that environment, losing their connection with the "place." For such individuals, the walkability of the urban space becomes a crucial feature, as it plays a significant role in sustaining daily practices and the relationship between individuals and their social and physical environment (Ertuğrul, 2019).

Extensive research has delved into the concept of walkability, yielding various definitions. In this context, several of these definitions have been examined. According to Southworth (2005), walkability pertains to the capacity of the built environment to facilitate pedestrian access to specific destinations in a safe and comfortable manner, all while offering visually appealing surroundings that endorse and stimulate walking. Bosselmann (2008) situates walkability as an attribute of sustainable cities, encompassing social and natural ecology, personal safety, comfort, and access to amenities. Jacobs (2011) links walkability to the active use of streets, underlining that a vibrant urban life thrives when streets are in active use. Dover and Massengale (2013) define walkable streets as areas where *"residential, commercial, and institutional zones converge, where cyclists feel most at ease, and public transportation is most efficient, enabling face-to-face interactions, nurturing strong social bonds, and ensuring safety"* (Ertuğrul, 2019).

Medieval cities were remarkable due to their high walkability rates. These cities concentrated all urban necessities within a central square area, where everything was within a half-mile walk. For example, Urbino in Italy covered only 300 acres and housed 30,000 people (Southworth, 2005). The early American cities were also designed with high walkability in mind. Boston, Massachusetts, with its mixture of various districts, stands as a classic example. In the early 19th century, before extensive land reclamation, everything was located on a small peninsula just over 800 acres in size, and every point could be reached within a one-mile or half-hour walk. Despite significant growth and modernization, the central area of the city still maintains an exceptional level of walkability (Karımı, 2022). Copenhagen, despite retaining its medieval narrow and grid-patterned structure, serves as a good example of a pedestrian-friendly city. The city's main 2.3-kilometer artery, "Stroget," has been transformed into a pedestrian street, making it the world's longest pedestrian pathway. Through minor adjustments, urban planners have shifted the city away from car-centric focus to become pedestrian-friendly. As a result of these actions, the city's accessibility and walkability rates have increased (Bağcı, 2019). In Italian cities, life complements itself through environment, weather conditions, and architectural factors. Urban spaces, therefore, promote walking by fostering a high degree of



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imaginability and a positive sense of place. In Galway, Ireland, people living in walkable neighborhoods know their neighbors and, as a result, trust each other more. This has turned them into a more social community, possessing social capital (Karımı, 2022).

The walking environment is considered a critical factor in creating a sustainable city because it contributes to the well-being of the city and its residents in areas such as health, social cohesion, safety, environment, and the economy. The specific contributions are outlined below:

Health (Ak, 2018; Bağcı, 2019; Ertuğrul, 2019; Mensi, 2021; Rhoads et al., 2023): In the past decade, a strong emphasis has been placed on walkability, primarily with the goal of improving public health. Walkability is viewed as a key factor in promoting health, as walking or cycling instead of driving has been shown to reduce the risk of heart disease, obesity, diabetes, and traffic-related injuries, according to Health Impact Assessment (HIA). The shock created by the COVID-19 pandemic in the past two years has underscored the importance of implementing "Open Streets" programs and has highlighted the significance of walkability in urban areas.

Social (Ak, 2018; Bağcı, 2019; Ertuğrul, 2019; Mensi, 2021; Velazquez et al., 2023): A city with extensive walkable areas fosters greater equality among different social classes, ethnic backgrounds, genders, and age groups. Such areas support and enhance social cohesion. Additionally, residents who walk to work or school and engage in daily activities by walking to local places and public spaces are more likely to lead active, healthier, happier, and sustainable lifestyles. Walkable spaces also strengthen social bonds among residents.

Environment (Bağcı, 2019; Mensi, 2021; Abastante et al., 2023; Velazquez et al., 2023): Urban mobility stands as one of the most effective solutions to the complex challenges cities face in sustainability and climate change resilience. Particularly, reducing car dependence can significantly mitigate its negative impacts on emissions, energy consumption, air and noise pollution. Walkability, by reducing dependency on fossil fuels used for transportation, can contribute to mitigating and adapting to climate change. Furthermore, designing walkable environments facilitates the construction of neighborhood or area-level green infrastructure features, including greenways, rain gardens, riverfront buffers, biological swales, permeable sidewalks, and green streets. This provides residents with more open space opportunities.

Safety (Bağcı, 2019; Mensi, 2021): One of the fundamental elements of walkability is creating a safe and healthy built environment through traffic design elements, traffic-calming measures, and vegetation to ensure real safety for the community. Moreover, walkability supports independence for individuals of all ages and abilities, contributing to a higher quality of life for everyone. When city residents feel safer, more people are encouraged to walk, which in turn enhances safety by preventing crime and improving public security.

Economy (Bağcı, 2019; Mensi, 2021): Recent research by the American Planning Association (APA) has demonstrated the positive impact of walkable environments on the economy. Similarly, Leinberger and Alfonzo (2012) categorized the economic benefits of walkability into four main areas: economic performance, effects of nearby walkable urban places, lower transportation costs, and social equity. More attractive walkable areas, vibrant social life, and active streets enhance commercial performance in the region. Walkability can also reduce expenses associated with car ownership. Residents who choose to walk to work or other nearby locations instead of using a car save on fuel costs, reduce transportation expenses, and improve access to public transportation.

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Gehl (2019) advocates for designing cities on a human scale, basing this approach on human capabilities and behaviors while emphasizing the significance of sensory organs. Consequently, the connection between physical form and human behavior becomes pivotal. Humans move on their feet, and the orientation of the human body is linear. Pedestrians walk faster on linear paths but slow down in plazas. The average walking speed in summer is 4.2 km/h, while in winter, it increases to 5.8 km/h. Although the walkable distance varies for pedestrians and is influenced by factors such as the elderly, people with disabilities, children, pavement quality, and the attractiveness of the route, a reasonable distance for many individuals is approximately 500 meters.

A reasonable walking distance of about 500 meters implies that city centers should also have a radius of 1 km. In a city with a 1 km radius, pedestrians can access most of the city's amenities by walking. The Chinese government argues that there should be 15-minute walkable neighborhoods to provide citizens with access to essential public services within a 15-minute walking distance, aiming to improve walking behavior and overall health. Figure 1 illustrates the types of amenities that should be located at 5, 10, and 15-minute distances within a 15-minute neighborhood (Şahin Deniz, 2022).

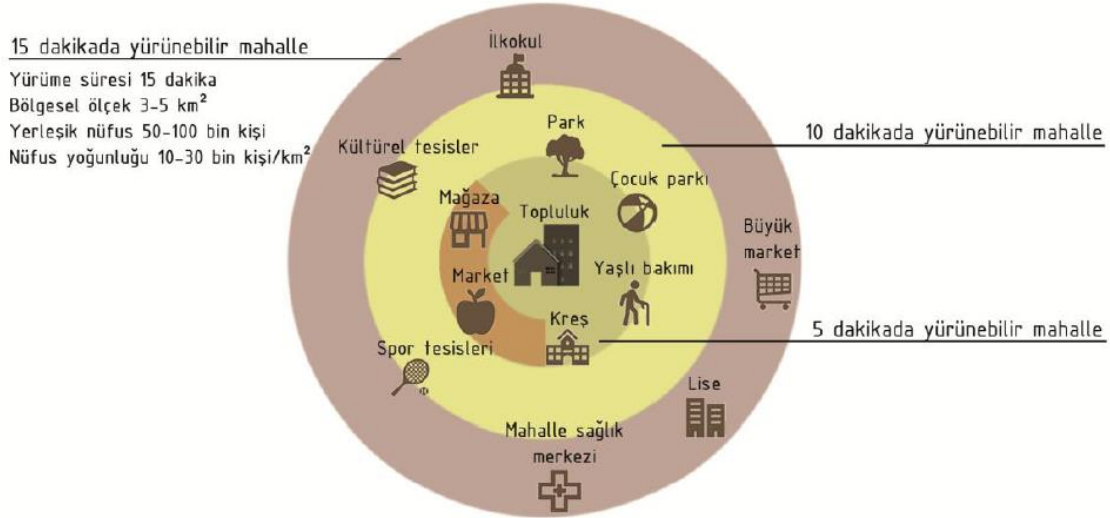


Figure 1. Uses within 5-10-15 minute distances in a walkable neighborhood.

Implementing regulations that promote physical activity in urban areas does not always suffice to encourage more people to walk. In this context, it is essential to understand which elements of the built environment primarily motivate individuals to walk. Scientific studies and research results highlight criteria that affect walkability, emphasizing features closely related to one another, such as scale, density, open spaces, accessibility, transportation systems, diversity, comfort, context, attractiveness, enclosure, legibility, transparency, street quality, and others. However, the relative importance of these identified criteria is still a subject of ongoing debate (Gündoğdu & Dinçer, 2020). In this regard, the evaluation, planning, and design of walkable cities should occur at various scales, including the city as a whole (macro), its subcomponents (meso), and individual streets (micro) (Ak, 2018).



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In Türkiye, walkability gained significance, especially in the early 2000s, in the context of accessibility for people with disabilities. In recent years, within the framework of the Ministry of Health's "*Healthy Nutrition and Active Life Program in Türkiye (2013-2017)*," walkability has come to be viewed as a significant tool in promoting a healthy lifestyle and combating obesity. While these developments hold promise for the development of walkable and livable cities, the extent to which contemporary cities are effectively planned and designed for walkability remains a subject of discussion (Akkar Ercan & Belge, 2016).

This study aims to evaluate the quality of walkability in urban areas by taking into account specific criteria. For this purpose, İstasyon Street, situated in the bustling city center of Burdur and widely frequented throughout the day, was selected as the research area. The walkability of İstasyon Street has been assessed and appraised using criteria encompassing scale, density, accessibility, diversity, street quality, safety, and comfort. The findings have paved the way for crafting recommendations to improve the standards of walkability in the urban planning and design of Burdur.

2. MATERIALS and METHODS

Materials

The primary material for this study is İstasyon Street, located in the city center of Burdur, which is intensively used throughout the day.

Burdur is situated in the interior of the Mediterranean Region, in the region known as the "Göller Yöresi," at the transition point from the Mediterranean Region to the Aegean and Central Anatolia Regions. It is located between 29° 24' and 30° 53' east longitudes and 36° 53' and 37° 50' north latitudes. The province covers an area of 7,176 km², with an elevation of 950 meters. Burdur is surrounded by the following provinces: Antalya to the east and south, Denizli to the west, Muğla to the southwest, and Afyonkarahisar and Isparta to the north (Directorate of EIA and Environmental Permits, 2023). The population of Burdur province is 273,799, while the population of the city center is 193,185 (TURKSTAT, 2023).

İstasyon Street is located in the city center of Burdur, between the Burç and Konak neighborhoods. The reason for selecting İstasyon Street as the research area is its significance in terms of pedestrianization, or in other words, walkability, and its extensive use by the city's residents. The street has a length of approximately 425 meters. To the north of the research area line, there are İstasyon Park and Burdur Train Station, while to the south, there is Cumhuriyet Square. Along the street, there are residential areas, commercial establishments, government offices, and educational facilities (see Figure 2).

For the research area, the 1/1000 scale Burdur Implementation Zoning Plan was obtained from the Burdur Municipality, and Google Earth satellite images were utilized as the base. The criteria for assessing the walkability of İstasyon Street were incorporated into the base using the AutoCAD 2021 software.

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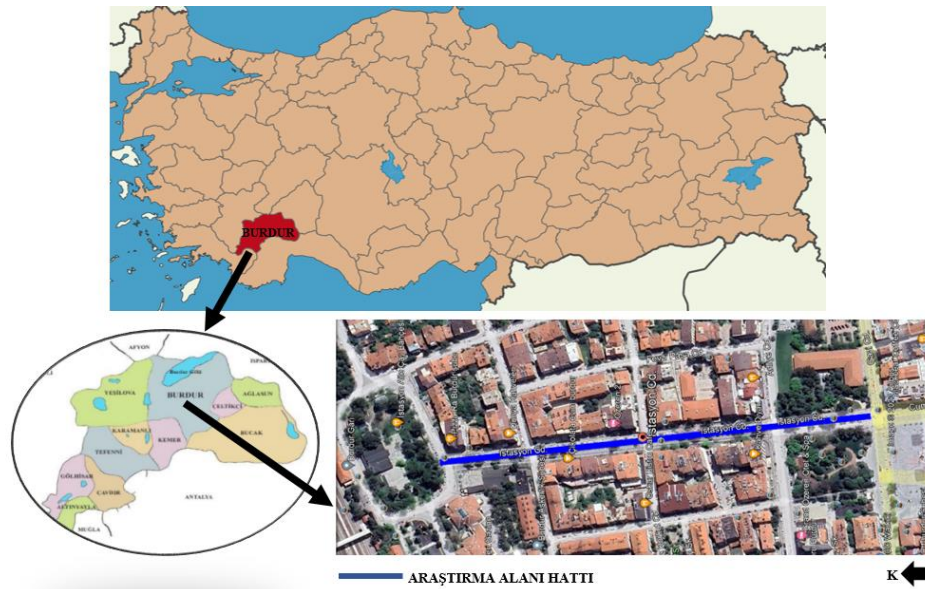


Figure 2. Research area location (accessed through Google Earth, 2023)

Methods

In the scope of this study, an initial literature review was conducted. Based on the information obtained from the literature review, criteria were established for evaluating the walkability of the research area. Building on the studies of Bağcı (2019), Ertuğrul (2019), Karımı (2022), and Şahin Deniz (2022), 7 criteria and their respective sub-criteria were identified (see Table 1).

Table 1. Walkability criteria and sub-criteria

Criteria	Sub-criteria
1. Scale	-
2. Density	-
3. Accessibility	3.1. Access to Public Transport 3.2. Parking Access 3.3. Access to Open and Green Areas 3.4. Barrier-Free Access
4. Diversity	-
5. Street Quality	5.1. Street Width 5.2. Street Signs 5.3. Street Furniture 5.4. Street Trees 5.5. Sidewalk Material 5.6. Sidewalk Width 5.7. Sidewalk Continuity 5.8. Street Maintenance
6. Security	-
7. Comfort	-

In the second stage, on-site observation was employed to assess the criteria influencing walkability. Photographs and videos of the area were taken. Furthermore, to determine pedestrian density, weekday and weekend pedestrian counts were conducted, with 10-minute

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intervals on each of these days. The counts were conducted during three different time frames: 08:00-09:00, 12:00-13:00, and 17:00-18:00. Separate counts were made for those heading from the Station Park to Republic Square and those heading in the opposite direction.

In the final stage, recommendations for enhancing walkability quality in Burdur's urban planning and design were developed based on the data collected and analyzed.

FINDINGS and DISCUSSION

The criteria and sub-criteria listed in Table 1 were evaluated within the scope of the research area.

Scale

In urban space, factors such as street widths, sidewalk widths, building heights, block sizes, street furniture dimensions, road width, etc., influence the relationship of the scale with walkability. To create walkable environments, it is important that these qualities of urban space are at the human scale. Vertical dimensions up to two, three, or at most four floors are defined as the human scale. In other words, it is also defined as the floor height that can be reached without an elevator. Streets with a street width-to-building height ratio of one create an optimal walkable environment and spatiality (Figure 3) (Ertuğrul, 2019).

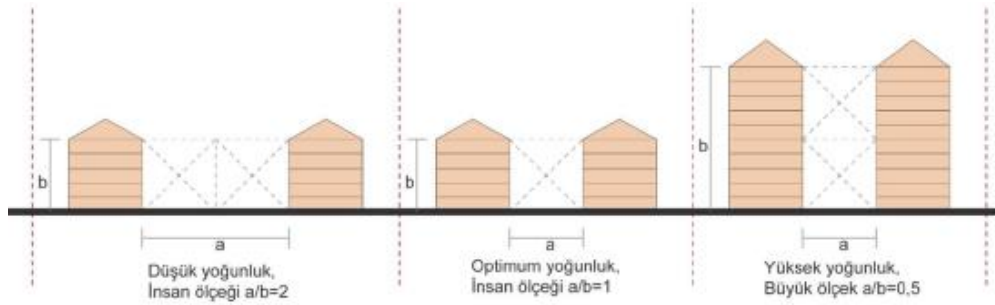


Figure 3. The ratio of street width to building height

If the building height is significantly greater than the width of the urban space, the human scale within the space disappears. The level of use in a space increases when the heights of buildings surrounding the environment are designed in proportion to the human body. Multi-story buildings break the human-building relationship by surpassing the human perception limit. Gehl (1978) notes that this relationship is particularly strong on the ground floor, diminishing as you go up to the third and fourth floors, and after the fifth floor, the sensory, visual, and social relationships are completely lost (Karımı, 2022).

In this context, when the building blocks on both streets in the study area are examined, it was determined that there are buildings with a minimum of 1 floor and a maximum of 5 floors (Figure 4). The average number of floors for both axes is 4. This situation indicates that the area is designed at a human scale. However, the scale determining factor in urban space is not only building heights. The ratio of street width to building heights should also be considered. The ratio of the street width in the study area to the building height is 1,75. Thus, it is determined that İstasyon Street creates a spacious spatial perception.

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Figure 4. Floor heights of the research area (Obtained from Burdur Municipality, 2023)

Density

Density measures the built environment or population in a specific area. In general, density is the ratio of the area occupied by buildings to the total land area or the ratio of people living or working within a specific area. Banz (1970) noted that human density reflects the density of use of the space (Ertuğrul, 2019).

To determine pedestrian density in the research area, the pedestrian crossing method used by Gündoğdu and Dinçer (2020) was employed. Within this method, pedestrian counts were conducted on two different days, namely, a weekend (September 3, 2023) and a weekday (September 7, 2023), in 10-minute intervals between 08:00-09:00, 12:00-13:00, and 17:00-18:00 in both directions (Cumhuriyet Square-İstasyon Park and İstasyon Park-Cumhuriyet Square) (Table 2).

Table 2. Pedestrian density within the research area

Time Periods	Weekend (03.09.2023)		Weekdays (07.09.2023)	
	Cumhuriyet Square-İstasyon Park Direction	İstasyon Park-Cumhuriyet Square Direction	Cumhuriyet Square -İstasyon Park Direction	İstasyon Park-Cumhuriyet Square Direction
08.00-09.00	19	23	33	26
12.00-13.00	36	41	66	83
17.00-18.00	164	137	255	235
Total	219	201	354	344

Due to the narrow street layout and pedestrianized nature of İstasyon Street, pedestrian use in this area is higher compared to other parts of the city. The research area is used by a total of 420 people on weekends and 698 people on weekdays. The peak hours for pedestrian traffic on both weekends and weekdays are between 17:00-18:00. İstasyon Street, in particular, is a frequented area for high school and university students. The reason for lower pedestrian density

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on weekends is that residents of the city often travel to nearby cities such as Isparta and Antalya. However, it's worth noting that the pedestrian counts conducted using the crossing method on both weekends and weekdays occurred during periods when the university was not in session, minimizing the impact of university students on these calculations.

Accessibility

Pedestrian-friendly cities are those that prioritize high accessibility for pedestrians. Accessibility demonstrates how well pedestrians can navigate a city's streets and avenues. Pedestrian movement and accessibility are the ability for all groups, including the elderly and individuals with disabilities, to move safely and convincingly within all transportation systems (Southworth, 2005). This criterion, as in the study conducted by Bağcı (2019), is examined through four sub-criteria: access to public transportation, access to parking, access to open and green spaces, and barrier-free access (Figure 5).

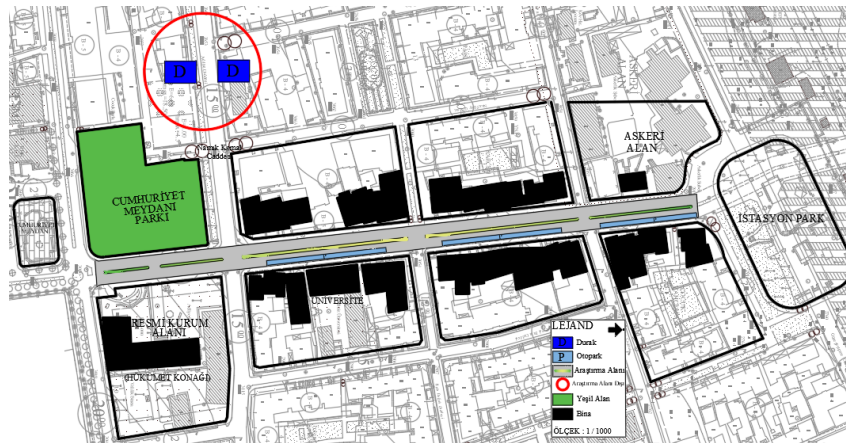


Figure 5. Accessibility analysis of the research area (Obtained from Burdur Municipality, 2023)

Access to Public Transport

Southworth (2005) has mentioned that in a larger city and region, access to reasonable distance and likely connections to other nodes will be provided. Therefore, an acceptable distance to transportation stations should be 400 to 800 meters or a 10-20 minute walking distance. This requirement enhances the walkability of the environment.

There are no public transportation stations within the defined research area. However, the bus stop located just outside the research area (two bus stops across from each other on Namık Kemal Avenue) can be reached in approximately 3 minutes (Figure 5, Figure 6). There is no taxi stand within the research area, and access can be achieved by private vehicle.



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Figure 6. Bus stops on Namık Kemal Street

Access to Parking

Parking is one of the significant elements of street design that can influence pedestrian behavior both positively and negatively. While it has become a focal point for access to public transportation, access to parking is still perceived as a necessity in traditional settlements, new developments, and public spaces. Zuniga-Teran et al. (2017) have pointed out that the fewer parking spaces are provided on streets, the more walkable they become, encouraging people to engage in physical activity through alternative transportation methods (Bağcı, 2019).

There are no public or covered parking facilities available for users and local residents within the research area. High pedestrian traffic and traffic congestion are observed in the area due to the lively commercial uses. Furthermore, users and local residents park their vehicles on the streets, which leads to narrowing road width and parking issues. Moreover, parking vehicles on the street restrict pedestrian and vehicular movements (Figure 5, Figure 7).



Figure 7. Vehicles parked on Station Street

Access to Open and Green -Spaces

In urban areas and neighborhoods, access to open and green spaces can be defined by the presence, size, proximity, and ease of access to vegetated areas. Streets should provide permeable pathways or access, be designed without physical barriers, offer convenience, and be accessible to the landscape. When examining urban plans, it is evident that green spaces play



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a crucial role in enhancing the quality of life and the city. There should be a small green area (2 hectares) within a 400 m walking distance (Bağcı, 2019).

Within the research area (in the direction from İstasyon Park to Cumhuriyet Square), there is one park located across from Cumhuriyet Square. This park is named Cumhuriyet Square Park. Due to its location, it is one of the most frequently used and bustling areas. The park serves as a gathering and resting point for city residents and is also where events at Cumhuriyet Square are observed. For a pedestrian entering from İstasyon Parkı, this park is approximately 375 meters away (Figure 5, Figure 8).



Figure 8. Cumhuriyet Square Park

Barrier-Free Access

Public spaces hosting various activities are important urban areas that facilitate communication and interaction among people. In order for individuals with disabilities to have equal rights and lead an inclusive life while participating in social activities, urban public spaces must be designed according to accessibility standards (Bağcı, 2019).

Based on direct observations, it is noted that there are ramps, guide paths, and wheelchair charging stations for wheelchair users on both sides of İstasyon Street to promote barrier-free access. The widths of the sidewalks on both the right and left sides in the direction from İstasyon Park to Cumhuriyet Square are found to be appropriate. However, on the left side, in the vicinity of the trees, contrasting grating or gravel that aids visually impaired individuals has not been used (Figure 9).



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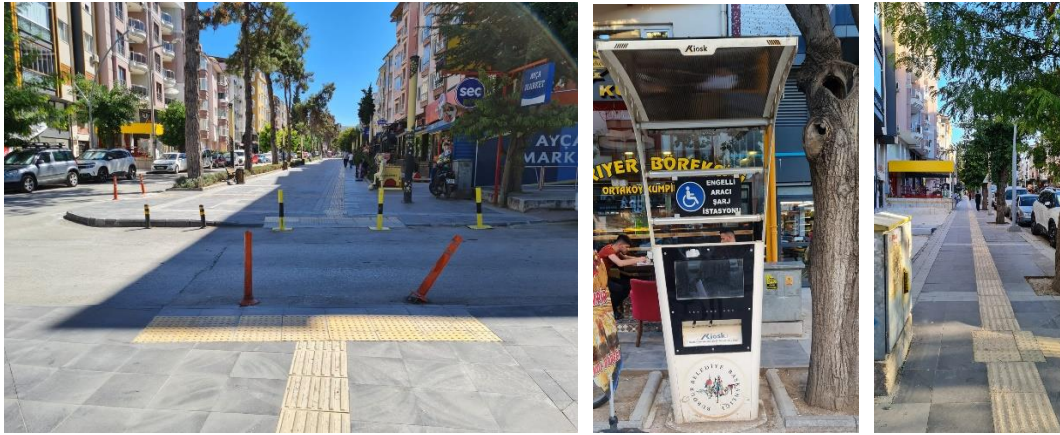


Figure 9. Examples of barrier-free access on Station Street

Diversity

Urban diversity is one of the most critical factors for vibrant street life. Urban diversity involves the integration of various functions within the built environment. The arrangements in the built environment influence the use of space and relationships among users. Preserving structures, landscape elements, streets, or names that have witnessed significant events or hold historical or emotional value for people is of utmost importance in maintaining urban diversity. The coexistence of structures from different eras is indicative of the visual diversity of a city (Bağcı, 2019; Ertuğrul, 2019; Karımı, 2022).

Aggregating commercial spaces selling similar products singularizes the functional use of that region. These types of spaces should be evenly distributed throughout the region, ensuring more equitable access for all city dwellers and stimulating commerce. Additionally, residents in an area should be able to meet all their needs within their own neighborhoods. For this purpose, each part of the city should host spaces catering to various needs such as housing, commerce, recreational activities, social interactions, and entertainment. Only through such an approach can compact city sections with diverse functions be created, eliminating the need for city residents to travel extensive distances between their homes and workplaces. Shaping urban spaces functionally in this manner ensures the development of livable city sections within walking distance (Bağcı, 2019; Ertuğrul, 2019; Karımı, 2022).

In the study area, in addition to spaces dedicated to essential functions such as commerce, residential areas, and shopping, the inclusion of areas designed for cultural, social, and recreational activities provides city inhabitants with the means to satisfy a broad spectrum of requirements. The variety found within the area caters to fundamental, choice-driven, social, and leisure needs, thereby fostering the development of a walkable and enjoyable space in close proximity. The area's diversity was assessed by taking into account the functional purposes incorporated within the structural blocks on both sides of the street (Figure 10).

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Figure 10. Regions where the diversity of the research area is evaluated (Obtained from Burdur Municipality, 2023)

In Area A, there are a total of 11 buildings, each featuring 22 distinct commercial establishments (including markets, cafes, restaurants, retail shops, pharmacies, etc.) situated on the ground floor. In Area B, there are a total of 12 buildings, with 24 diverse commercial enterprises (such as markets, cafes, restaurants, retail outlets, pharmacies, etc.) occupying the ground floor. The data indicates that multiple types of commercial enterprises coexist within each building (Table 3).

Table 3. Research area diversity

Diversity	Region A	Region B
Health Unit	-	1
Pharmacy	1	2
Beauty Center	-	1
Gym	1	1
Educational Facility	-	2
Housing	-	2
Market	3	1
Cafe / Restaurant	13	7
Market for Pets	1	1
Trade	2	3
Vacant	1	3
Total	22	24

Street Quality

Streets have been pivotal public spaces since the advent of social life, where public interaction, sharing, transportation, and mobility emerged. Therefore, in order to enhance walkability and



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public sharing, streets need to be functionally and aesthetically organized for everyone. In other words, streets should be arranged with quality, sustainable management, and a healthy urban perspective (Bağcı, 2019). In this context, street quality is assessed through sub-criteria, including street width, street signage, street furniture, street trees, pavement materials, pavement width, pavement continuity, and street maintenance.

Street Width

Pedestrian pathways should be separated from roadways on streets, and bike lanes should be included. In some cases, restricting access to the frontage may be necessary, and parking on the street may be allowed, or, in other situations where traffic is heavy, street parking should be discouraged (Bağcı, 2019).

Within İstasyon Street, pedestrian pathways and roadways are separated, but no provision has been made for bike lanes (Figure 11).



Figure 11. A sign in the research area where bicycle entry is prohibited

In the study area, the street's width is approximately 21 m, with a road width of around 6.40 m (Figure 12). Furthermore, parking vehicles on the street leads to traffic congestion.

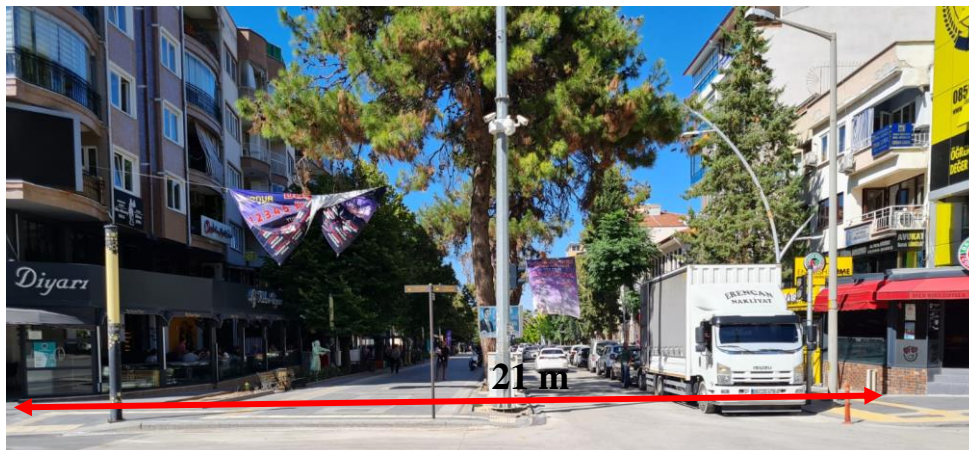


Figure 12. Research area street width



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Street Signs

Incoherent signage that creates visual clutter and confusion plays a pivotal role in shaping the perception of a city. According to Lynch (1960), a city should be both legible and recognizable. Urban design, in this regard, emerges as a paramount determinant of urban identity. Through the elements of urban design, an entire street in the city can be transformed into a harmonious, novel, aesthetically pleasing space that resonates with the city's culture and identity. For instance, in a study conducted in Türkiye, street arrangements, the colors of commercial signage, signs affixed to facades and sidewalks/pedestrian walkways, exhibitions, tables, and chairs were tested using virtual environments. The findings revealed that streets with monochromatic signs were deemed more suitable and were preferred for shopping compared to streets with polychromatic signage (Bağcı, 2019).

Within the research area, there are various ground-level uses. Each establishment employs signs to convey information about these uses and guide city residents to their respective locations. However, well-designed and harmonious signs are conspicuously absent. There is no shared visual language, and advertising billboards substantially diminish the ambiance of the space (Figure 13).



Figure 13. Street signs within the research area

Urban Furniture

Urban furniture encompasses objects within the urban landscape that serve to ease individual and social life, facilitate interpersonal interactions, bestow functionality and aesthetics upon space, and come in various qualitative and quantitative forms. Furthermore, urban furniture carries cultural and social significance in the daily routines of urban life, contributing to the city's identity (Bağcı, 2019).

Through direct street-level observations, it is evident that street furniture, notably waste bins, benches, and lighting fixtures, has been thoughtfully arranged. Signs of vandalism are apparent on recycling bins, clothing and shoe collection bins, and other pieces of furniture, which detrimentally affect the overall quality of the street. Additionally, İstasyon Street boasts sculptures that invigorate the ambiance of the space and have become integral components of the city's identity (Figure 14).



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Figure 14. Street furniture within the research area

Street Trees

Street trees play a vital role in urban centers by improving the quality of life, enhancing the city's visual appeal, bolstering ecological characteristics, reducing carbon dioxide emissions, and carbon sequestration. However, it is imperative that street trees do not impede pedestrian crossings, visibility, or road and street utilization (Bağcı, 2019).

As you progress towards Cumhuriyet Square from İstasyon Parkı, you'll encounter *Pinus brutia* gracing the central median within the research area, accompanied by *Lavandula angustifolia*. This central median, extending from the Burdur Governor's Bulfind to Cumhuriyet Square Park, maintains its *Pinus brutia* presence, with *Rosa* sp. beneath. Along the same path, the right



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side of the median features Rosa sp. in the parterre. At intervals along the right side, one can spot various tree species like *Fraxinus excelsior* and *Tilia cordata*. On the left side (following the roadway), different tree species such as *Fraxinus excelsior*, *Tilia cordata*, and *Jacaranda mimosifolia* have been thoughtfully planted. Notably, the plant selection for İstasyon Street did not fully incorporate design elements and principles (Figure 15). It's important to emphasize that the chosen plantings within the research area do not obstruct pedestrian access.



Figure 15. View of street trees within the research area

Sidewalk Material

A sustainable and robust sidewalk is one that's thoughtfully designed to integrate seamlessly with the local environment. When it comes to pedestrian spaces, the priority lies in selecting materials known for their durability, surface evenness, and resistance to slipping. These materials should be resilient, ensure safety, and allow for easy replacement when needed (Bağcı, 2019). In the research area, both sidewalks providing pedestrian access are crafted using basalt and andesite cobblestones. It's noteworthy that these sidewalk materials show no signs of deformation. However, during periods of heavy rainfall, the surface may become slippery, presenting certain challenges (Figure 16).



Figure 16. Materials and pavement dimensions used in pavement in the research area



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Sidewalk Width

The width of sidewalks is determined based on factors such as their urban location, the population they serve, land usage, and user density. For instance, in city centers where a variety of functions coexist, sidewalks tend to be wider due to their functional appeal and the high volume of pedestrian traffic attracted by transportation hubs. According to the "*Urban Roads - Design Criteria for Preventive Barriers on Sidewalks (2012)*" guide published by the Turkish Standards Institute (TSE), the minimum pedestrian width should be 1,50 meters. Furthermore, this guide specifies ideal sidewalk widths. These are (Bağcı, 2019):

- In cases where pedestrian sidewalks are not needed, shoulders ranging from 0.75 to 2 meters in width should be provided. For district connections, regional collector roads, inner and service roads on highways, pedestrian walkways at least 2 meters wide should be established on both sides of the road.
- On roads without front gardens, the pedestrian sidewalk should be at least 2.50 meters wide. In areas with heavy pedestrian traffic, like commercial districts, office areas, public buildings, and central business districts, the sidewalk's width should be a minimum of 5 meters.
- If the road width is insufficient, sidewalk width can be reduced to as little as 3 meters. However, in new road arrangements in residential areas designated for urban development, the sidewalk's width should not fall below 1 meter.

Within this context, the widths of sidewalks in the research area adequately accommodate pedestrian traffic (Figure 16).

Sidewalk Continuity

In pedestrian sidewalk design, the fundamental principle is to ensure the safety and comfort of pedestrians while, at the same time, providing the shortest path from one point to another to maintain the continuity of the street. Sidewalks should not contain any obstacles (such as obstructions, advertising billboards, utility poles, garbage containers, vehicles, store merchandise, etc.) that impede pedestrian movement and/or jeopardize their safety (Bağcı, 2019).

Within the research area, sidewalk continuity is often preserved. However, sidewalks separated by side streets are sometimes obstructed by parked vehicles at their starting or ending points. Moreover, despite the prohibition of motor vehicle entry into the area, these vehicles are still used, disrupting sidewalk continuity.

Street Maintenance

The preservation and maintenance of urban furniture and infrastructure elements in public spaces are essential for ensuring the continuity of the quality of life and the pedestrian network. In urban spaces, the sustainability of social activities and user satisfaction is only possible in a healthy and clean environment. Ensuring good health conditions for all urban residents, maintaining their continuity, and taking preventive measures in situations that threaten public health are crucial in considering the importance of environmental health in urban areas (Bağcı, 2019). Within this context, the study area provides a clean environment for users. However, inscriptions and deformed appearances on street furniture have a negative impact on street maintenance.



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Safety

The continuous visibility of the street, the absence of high-walled structures in the area, and well-lit streets are some of the characteristics that make the area secure. From a traffic safety perspective, there is a more extensive sidewalk area where pedestrians can walk safely.

The parked vehicles surrounding the traffic do not generally threaten the safety of pedestrians, but vehicles, in general, dominate a significant portion of the street. In addition, moving vehicles are considered safe as they cannot travel at high speeds. To enhance this safety, speed bumps are also present on the roads. Crosswalks are available to ensure pedestrians can safely cross from one side to the other.

Another contributing factor to the region's safety is that many establishments in the study area remain open late into the night, and residents are often out on the streets until the late hours. Street lighting within the area contributes to increased security (Figure 17).



Figure 17. Evening lighting view from the research area

Comfort

The sidewalk widths that promote pedestrian comfort and encourage walking are consistent on both sides of the street, providing city residents with a comfortable walking experience. As depicted in Figure 17, the sidewalk on the left side is suitable for group walking.

The street trees lining the street create a scenic effect throughout the area. The evening and nighttime lighting of the area ensures that the space is comfortably usable.

3. CONCLUSION and RECOMMENDATIONS

This study delves into the significance of walkability in human life and its critical role in shaping livable environments, examining various criteria that influence walkability. These criteria encompass factors like scale, population density, accessibility, diversity, street quality, safety, and comfort.

What we observe is that urban dwellers tend to gravitate towards areas where these criteria are reasonably met, consequently fostering the development of more livable urban landscapes. Maintaining a human-scale environment allows city residents to navigate the streets more efficiently, while diversity promotes the presence of various groups throughout the day, ultimately enhancing both the usage and safety of these streets. Moreover, there exists a strong



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correlation between the diversity of functions, space utilization, and pedestrian density. Safety within the area extends its usability into late hours. Enhancing accessibility contributes to denser usage. Establishing the requisite comfort conditions encourages city residents to stroll through the streets at a more leisurely pace, facilitating their assimilation into the urban space. Elements such as urban furniture play a role in fostering socialization among residents. In addition, it is crucial that urban furniture in each city is designed and manufactured in harmony with the city's unique identity. The establishment of a coordinating commission for urban furniture among existing elements can help create a shared design language. Vandalism affecting street furniture has repercussions not only on street quality but also on safety considerations. Therefore, campaigns to raise awareness are essential. Given that all the criteria mentioned are interconnected, achieving their optimal balance is paramount. The specific levels of optimization vary depending on the location, social structure, and space.

In contemporary cities, it is impractical to traverse the entire urban landscape solely on foot. Consequently, cities should prioritize walkability at the local level while also providing macro-scale pedestrian-focused alternative transportation systems for accessibility. In the specific context of Burdur, emphasis should be placed on pedestrian-oriented transportation systems. Transportation plans should be developed or revised accordingly, ensuring that the city and its residents have increased access to pedestrian-friendly areas. In this context, the inclusion of Gazi Street as a pedestrian-focused zone in alignment with the research area is recommended.

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**THE ROLE AND IMPORTANCE OF MUNICIPALITIES IN EARTHQUAKE
DISASTER RISK AND CRISIS MANAGEMENT**

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ABSTRACT

Natural processes such as earthquakes, floods, erosion, landslides, and hurricanes have always occurred and will always occur since the world has existed. These natural processes turn into natural disasters by causing loss of life and property due to reasons such as the incompatibility of human versatile activities with natural processes, damaging approaches, and not taking necessary precautions. In particular. Since our country is located in an earthquake zone and it is not known where, when, what magnitude, how, and what type of earthquakes will occur, it is a vital necessity to take necessary measures within the scope of risk and crisis management to minimize possible material and moral damages. In Türkiye, disaster management is managed by (AFAD). Municipalities have assumed only a support role. However, due to the centralized structure experienced in the disasters, the role or intervention effect of local administrations has been reduced especially in the first critical moments of the disaster phase and afterward, the coordination between the center and local bodies and NGOs has not been established. The purpose of "Disaster and Risk Management" is to ensure that the technical, administrative, and legal works required are carried out by both central and local administrations and all public institutions and organizations together with non-governmental organizations with the participation of the public to ensure that rapid and effective rescue, first aid, temporary sheltering and reconstruction activities are carried out during and after the disaster with the measures to be taken before the disaster to prevent disasters in settlements, to be prepared against disasters and to reduce their damages are carried out within a system. While providing disaster and risk management, local administrations should be at the center of this work by the concept of subsidiarity. Because municipalities are one of the leading partners of the efforts aiming to be resilient against disasters. The role of municipalities in risk and crisis management and organization is of great importance in ensuring the safety and well-being of communities affected by disasters. In this context, it is responsible for minimizing the impact of disasters such as earthquakes, responding quickly, providing recovery efforts, and building resilience to prevent or mitigate future disasters. In this study, the roles, duties, and responsibilities of municipalities in risk and crisis management before, during, and after earthquake disasters are revealed, current problems are revealed with SWOT analysis under 3 main headings, and suggestions are made by making evaluations.

Keywords: Earthquake, Disaster, Risk and Crisis Management, Municipalities, Local Governments.



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1. INTRODUCTION

Natural processes such as earthquakes, floods, erosion, landslides, and hurricanes have always occurred and will always occur. According to the United Nations, half of humanity now lives in cities. The urban population has been exceeding the rural population since 2008 and this rate is expected to be around 70% in the 2050s (Albrito, 2012).

These natural processes turn into natural disasters by causing loss of life and property due to reasons such as human multifaceted activities not being compatible with natural processes, having damaging approaches, and not taking necessary measures. As a result, natural disasters are a human-induced result.

The turning point in the field of disaster management and coordination in Türkiye was the Marmara Earthquake of August 17, 1999. This earthquake, which caused great loss of life and extensive damage, painfully demonstrated the necessity of revisiting the issue of disaster management in Türkiye. Accordingly, the General Directorate of Civil Defense under the Ministry of Interior, the General Directorate of Disaster Affairs under the Ministry of Public Works and Settlement, and the General Directorate of Emergency Management of Türkiye under the Prime Ministry were closed down and the "Disaster and Emergency Management Presidency" under the Prime Ministry was established with the Law No. 5902 enacted in 2009 and the authorities and responsibilities were gathered under a single roof. The Presidency was affiliated with the Ministry of Interior with Presidential Decree No. 4 published on July 15, 2018. The Disaster and Emergency Management Presidency continues to operate as a flexible and dynamic institution that ensures cooperation among all institutions and organizations of the country to plan, direct, support, coordinate, and effectively implement the activities required for the prevention of disasters and mitigation of their damages, response to disasters and rapid completion of post-disaster recovery efforts. In this framework; a new disaster management model has been put into practice in Türkiye and with this model, priority has been given from "Crisis Management" to "Risk Management". This model, which is nowadays called an "Integrated Disaster Management System", envisages the identification of hazards and risks in advance to prevent the damages caused by disasters and emergencies, taking measures to prevent or minimize the damages that may occur before the disaster occurs, ensuring effective response and coordination, and carrying out post-disaster recovery works in integrity (AFAD, 2018).

The aim of "Disaster and Risk Management" is to ensure that the technical, managerial, and legal works required to be carried out by both central and local administrations and all public institutions and organizations together with non-governmental organizations are carried out within a system with the participation of the public to ensure that rapid and effective rescue, first aid, temporary sheltering, and reconstruction activities are carried out during and after the disaster with the measures to be taken before the disaster to prevent disasters in settlements, to be prepared against disasters and to reduce their damages.

Disaster management in Türkiye is managed by the central administration "AFAD". Municipalities have assumed only a support role. However, the centralized structure experienced in disasters has reduced the role or intervention impact of local governments and led to a lack of coordination between the center and local bodies and NGOs, especially during and after the first critical moments of the disaster phase. One of the most painful examples of this is the regional earthquake disaster centered in Kahramanmaraş on February 6, 2023. The



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February 6 earthquake disaster has shown how vital it is to implement holistic strategic actions in the short and long term, before, during, and after the earthquake process. However, the regional earthquake disrupted the first response and disaster management due to the centralized structure and produced undesirable results.

While providing disaster and risk management, local administrations should be at the center of this work following the concept of subsidiarity. This is because municipalities are one of the leading partners in efforts aimed at disaster resilience. The role of municipalities in risk and crisis management and organization is crucial in ensuring the safety and well-being of communities affected by disasters. In this context, they are responsible for minimizing the impact of disasters such as earthquakes, responding quickly, providing recovery efforts, and building resilience to prevent or mitigate future disasters.

Municipalities have been assigned certain duties and responsibilities under both Article 7 of Metropolitan Municipality Law No. 5216 and Article 53 of Municipal Law No. 5393. However, these are not at a sufficient level. Besides, the fact that some of the metropolitan municipalities, non-metropolitan provincial municipalities, and district and town municipalities do not have units or directorates related to disaster management constitutes a major problem.

In this study, the roles, duties, and responsibilities of municipalities in risk and crisis management for natural disasters under 3 main headings: Pre-disaster phase (Preparation), Disaster phase (Confrontation), and Post-disaster phase (Recovery) have been examined and solutions have been proposed.

2. MATERIALS and METHODS

Examining the existing legislation related to municipalities and issues related to natural disasters have been identified and analyzed. In addition, a SWOT analysis was made to determine the current situation in municipalities for natural disasters. Service units in the management organization in municipalities were defined. Duties and responsibilities that municipalities should undertake in 3 dimensions pre-disaster, during, and post-disaster are proposed.

3. RESULTS and DISCUSSION

3.1. Local Government and Municipalities:

Municipalities, the most well-known local government unit by citizens (Bayrakçı, 2018, p. 305), date back to the 1800s (Ottoman Empire). Municipalities are regulated in their latest form in the Municipality Law dated 03.07.2005 and numbered 5393. Municipal Law No. 5393 defines a municipality (Art.3/a) as "a public legal entity with administrative and financial autonomy, established to meet the local common needs of the residents of the municipality and whose decision-making bodies are elected by the electorate" (Belediye Kanunu, 2005).

Municipalities are public legal entities in charge of meeting the common needs of the local population. They are the institutions where services can be provided in the most effective, rational, and fastest way (Urhan, 2008).

Article 14 of the Municipality Law No. 5393 stipulates the duties and responsibilities of the Municipality; (Belediye Kanunu, 2005).



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a) *"Provided that it is of a local common nature, the Municipality shall provide or have provided: urban infrastructure such as zoning, water and sewerage, transportation; geographical and urban information systems; environmental and environmental health, cleaning and solid waste; zoning, fire brigade, emergency aid, rescue and ambulance; urban traffic; burial and cemeteries; afforestation, parks and green areas; housing; culture and arts, tourism and promotion, youth and sports secondary and higher education student dormitories, social services and assistance, marriage, vocational and skill acquisition; development of economy and trade services."* (Belediye Kanunu No. 5393, 2005).

There are five types of municipalities in Türkiye: metropolitan municipalities, provincial municipalities, metropolitan district municipalities, district municipalities, and town municipalities. According to the official website of the Ministry of Interior, there are 30 metropolitan municipalities and 51 provincial municipalities in Türkiye.

3.2. The Current Situation and Examination of the Duties and Responsibilities of Municipalities Regarding Natural Disasters in the Existing Legislation in Our Country

The duties and responsibilities of municipalities in the face of earthquake disasters are specified below in Metropolitan Municipality Law No. 5216 and Municipality Law No. 5393.

Article 7 (Duties, Authorities, and Responsibilities of the Metropolitan Municipality) of the Metropolitan Municipality Law No. 5216 (Official Gazette Date: 23/7/2004, Issue: 25531). (Büyükşehir Belediyesi Kanunu, 2004).

u) By the plans made at the provincial level, to make plans and other preparations for natural disasters at the metropolitan scale; to support other disaster areas with tools, equipment and materials when necessary; to carry out fire brigade and emergency aid services; to identify places of production and storage of explosives and flammable substances, to inspect residences, workplaces, entertainment places, factories and industrial establishments and public institutions in terms of measures to be taken against fire and other disasters, and to issue permits and licenses required by the legislation in this regard,

z) Providing all kinds of support upon request of district municipalities for the evacuation and demolition of buildings at risk of disaster or posing a danger to life and property.

Article 53 (Emergency Planning) of the Municipal Law No. 5393 (Date of Publication in the Official Gazette: 13/7/2005 Number: 25874) (Belediye Kanunu. 2005).

o The municipality shall make the necessary disaster and emergency plans and prepare the necessary teams and equipment, taking into account the characteristics of the municipality, to protect against fire, industrial accidents, earthquakes, and other natural disasters or to reduce their damages.

o In the preparation of emergency plans, coordination shall be ensured with other emergency plans at the provincial scale, if any, and the opinions of relevant ministries, public institutions, professional organizations, universities, and other local administrations shall be taken.

o In line with the plans, necessary measures shall be taken for public education and joint programs may be carried out with the administrations, institutions, and organizations listed in the second paragraph.



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o In case of fire and natural disasters outside the boundaries of the municipality, the municipality may provide necessary assistance and support to these regions.

Under the heading of land and housing production, Article 69; (Belediye Kanunu. 2005).

..... land can be allocated to those exposed to disasters, to those who will be transferred from industrial zones, and to cooperatives whose members are all in this situation, at an amount not less than the amount to be determined by the appraisal commission established by the provisions of the Expropriation Law No. 2942.

Regarding Urban Transformation and Development Area Article 73- (Amended: 17/6/2010-5998/1 Art.): (Belediye Kanunu. 2005).

Municipalities may implement urban transformation and development projects with the decision of the municipal council to create housing areas, industrial areas, commercial areas, technology parks, public service areas, recreation areas, and all kinds of social reinforcement areas, to rebuild and restore the old parts of the city, to protect the historical and cultural texture of the city or to take measures against earthquake risk.

3.3. Management Organization and Service Units in Municipalities

Municipalities try to carry out their services and activities within the framework of the legislation under different units within the framework of management organization. The names and number of units in the municipal administration may vary according to the population and needs.

- Department of Building Control: It carries out duties related to the inspection, correspondence, works, and transactions related to all existing structures, burned and demolished structures, licensed constructions, structures contrary to the license, and annexes within the municipality borders (Ercan, 2017).

- Department of Public Works: It carries out all kinds of construction works planned by the municipality, as well as the opening, construction, and repair of roads within the municipality's jurisdiction. In addition, all kinds of demolition works carried out by the municipality are also carried out by this directorate (İstanbul Büyükşehir Belediyesi (IBB), 2023; Belediye Kanunu, 2005).

- Department of Zoning and Urbanization: By the relevant laws and regulations of these laws, this department supervises zoning activities within the boundaries of the municipality, issues building permits and occupancy permits, gives opinions of conformity regarding construction and building height, in short, performs all duties related to zoning (IBB, 2023; Belediye Kanunu, 2005).

- Department of Parks, Gardens, and Green Areas: One of the main duties of the Department is to develop and supervise projects for playgrounds, gardens, pedestrian paths, and green areas within the boundaries of the municipality (IBB, 2023; Belediye Kanunu, 2005).

- Department of Cultural Heritage: One of its main duties is to prepare/ have prepared urban design projects for immovable cultural assets, protected areas, and historical environments that need to be protected, and to supervise surveying and restoration works (IBB, 2023).



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- Department of Earthquake Risk Management and Urban Improvement: Its task is to identify disaster risks within the municipality boundaries, create hazard maps, and develop/implement plans and projects to reduce earthquake risk (IBB, 2023; Belediye Kanunu, 2005).
- Rail System Department: To make/make the rail system routes, the necessary project, the materials to be used, the necessary modification works, in short, every detail related to the rail system, and to inspect and control all of these (IBB, 2023).
- Department of Real Estate Management: The operations and management of the immovable properties that the municipality needs or owns are carried out (IBB, 2023).
- Department of Support Services: Its task is to maintain and repair all buildings and facilities owned or used by the municipality (IBB, 2023; Belediye Kanunu, 2005).
- Department of Studies and Projects: Evaluates and examines infrastructure, superstructure, and urban design projects, and prepares the project if deemed appropriate. Works in coordination with other units (IBB, 2023).

In the study conducted by Özdemir in 2023, "The corporate websites of metropolitan and provincial municipalities in 81 provinces were examined and their existing units related to disasters were investigated. Among 30 metropolitan municipalities, 22 of them have disaster-related units while 8 of them do not have any disaster-related units. It is seen that 7 of the metropolitan municipalities have Departments of Earthquake Risk Management and Urban Improvement. It is determined that 17 of the metropolitan municipalities have Disaster Coordination Center (AKOM) units.

In 51 provincial municipalities that do not have metropolitan status, there is no unit for disaster services. In some municipalities, disaster management services are tried to be carried out through civil defense experts or civil defense units. There is no AKOM in provincial municipalities. It has been determined that very few district municipalities have established AKOMs and carry out activities for disaster services.

4. RESULTS and DISCUSSION

4.1. SWOT Analysis and Analysis of Municipalities for Disaster Management

SWOT analysis of municipalities on issues such as building inspection and retrofitting, zoning practices, legal studies, financial resource studies, training studies, social activities, and disaster and risk management strategies were conducted.

Table 1. SWOT analysis to determine the current situation regarding natural disasters in municipalities

Strengths	<ul style="list-style-type: none"> • 22 of the 30 metropolitan municipalities have disaster-related units, • 17 of the Metropolitan Municipalities have a Disaster Coordination Center (AKOM) unit, • Presence of Departments of Earthquake Risk Management and Urban Improvement in 7 of the metropolitan municipalities, • Municipalities have the infrastructure to create temporary shelter areas after disasters, • Municipalities have sufficient knowledge and experience in natural disasters.
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Weakness

- Article 7 of the Metropolitan Municipality Law No. 5216 and Article 53 of the Municipality Law No. 5393 do not detail the powers and responsibilities given to municipalities,
- Lack of a strategic management approach and vision for natural disasters in municipal administrators,
- Only 7 of the metropolitan municipalities have Departments of Earthquake Risk Management and Urban Improvement,
- 51 provincial municipalities without metropolitan status do not have any unit for disaster services,
- Lack of a Disaster Coordination Center (AKOM) in provincial municipalities,
- Failure to establish Disaster Coordination Centers (AKOM) in district municipalities and inadequate work on disaster services,
- Among the 30 metropolitan municipalities, 8 of them do not have disaster-related units,
- Lack of local earthquake master plans,
- Failure to reflect the holistic decision-making process for natural disasters in urban development plans,
- Lack of educational activities in municipalities to raise awareness of urban people about natural disasters,
- Inadequate number of technical and auxiliary personnel, tools, and equipment capacity in the approval, inspection, and control processes of construction projects in municipalities,
- Although it is compulsory in municipalities, the Urban Information System is still not established or activated,
- Ineffective use of geographical information systems,
- Urban green space planning and organization is not handled holistically,
- Lack of adequate areal size and multi-purpose functionality of green areas at urban and neighborhood scale and lack of association with natural disasters,
- Lack of or insufficient joint work and cooperation with voluntary institutions and organizations such as the City Council and NGOs on Natural Disasters,
- Lack of strong technological infrastructure,
- Lack of coordination and communication between units within the Municipality,
- Inadequate performance monitoring and evaluation system in municipalities,
- Inadequate drills on natural disasters within the municipality,
- Lack of development of warning-warning systems, etc.



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Opportunities	<ul style="list-style-type: none"> • Municipalities' local facilities are easier to use at every stage of the earthquake disaster, • The ability of municipalities to identify temporary shelter and gathering areas when making development plans, • Voluntary communities such as city councils, NGOs, student clubs, • The existence and experience of AFAD and experienced NGOs.
Threats	<ul style="list-style-type: none"> • Municipalities do not take into account the geological-geotechnical ground surveys for the zoning plan during the construction of the zoning plans, and therefore, the earthquake disaster, • Earthquake risks are everywhere in Türkiye. • A high economic profit (rent) system is widespread in the construction sector and ethical values are gradually weakening, • Inadequate holistic supervision and control mechanisms in state institutions and organizations.

4.2. General Framework of Duties and Responsibilities of Municipalities in Natural Disaster Risk and Crisis Management

It is not possible to predict and prevent earthquake disasters and many other disasters. For this reason, rather than preventing earthquake disaster, measures can be taken in three stages pre-disaster, disaster moment, and post-disaster to warn, warn, and reduce the physical, social, and economic losses it will cause after the disaster (Geray, 1977).

According to Solway (2004), the role of local governments in natural disaster management should be as follows; a. Identify vulnerable people and areas in the region b. Ensure that all members of the community are aware of the potential impacts of natural disasters c. Distribute advisory notes and implementation guides for disaster mitigation to the community d. Contact authorities responsible for planning, building, health, and welfare, issue warnings or provide fire and crowd control systems e. Ensure that citizens receive appropriate first aid training f. Work with educational institutions to implement citizen education and awareness programs e. Identify escape routes and the location of safe environments and shelters (Solway, 2004: 304):

A disaster and Risk management system is a system that requires continuity and consists of intertwined phases. According to this system, disaster and risk management consists of mitigation, preparation, rescue and first aid, recovery, and reconstruction stages (Ergünay, 1999).

1. Pre-Disaster Phase
2. Natural Disaster Sequence Phase
3. Post Natural Disaster Phase

4.2.1. Pre-disaster phase (Preparation),

The pre-disaster stage is the first stage of the risk management system consisting of mitigation, prevention, and preparation stages to save society from natural disasters with minimum material and moral damage. The main headings are as follows.



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- a. Municipalities should effectively and competently carry out all duties related to the settlement and license process and zoning within the municipal boundaries within the framework of legislation and ethics. One of the most essential conditions for overcoming natural disasters and especially earthquakes with minimum casualties is to ensure the construction of earthquake-resistant buildings produced with earthquake-resistant projects by environmental and physical plans and to prevent the construction of earthquake-resistant buildings contrary to the license and the attached project and plan. The task of ensuring the implementation and control of the existing legislation in the creation of resilient cities and structures has been assigned to municipalities within the municipal boundaries and to governorships and district governorships outside the municipal boundaries.
- b. For this purpose, it is imperative that the approval and control processes of building projects are carried out by the Department of Zoning and Urbanization by the purpose. The number of technical and auxiliary personnel, tools, and equipment capacity of the unit in terms of quantity and quality must be improved.
- c. "Natural Disaster Management and Coordination Unit" should be established in each municipality and defined in the legislation. Plans for possible disaster and risk management should be prepared and developed. "Rescue and Emergency Aid Plans, Team duties and responsibilities, training and exercise activities of personnel, regional equipment centers, stocking of critical materials, etc. should be defined and updated every 2 or 3 years.
- d. Natural disaster risk map of existing buildings should be prepared and an emergency action plan should be created. It should be integrated with the Urban Information System.
- e. Building control and inspection mechanisms should be realized continuously and effectively.
- f. Municipalities should consistently implement building heights of a maximum of 3 floors.
- g. Urban green space planning and organization should be handled holistically. Parks with sufficient area and multi-purpose functionality should be created at the city and neighborhood scale. These parks should have sufficient area size and accessibility to provide services such as gathering, accommodation, and first aid during natural disasters. Natural disaster containers should be located in each neighborhood park.
- h. Awareness and awareness-raising activities should be organized with relevant stakeholders on natural disasters. Rescue and Emergency Assistance Teams should be the first to see and take responsibility.
- i. Research and practices should be carried out for the establishment, operation, and development of natural disaster alarm and early warning systems.
- j. It is obligatory to establish a city council in each municipality. Voluntary participation should be ensured by forming a Natural Disaster Working Group and Rescue and Emergency Aid Working Group to be formed within the scope of the city council. Cooperation and coordination should be ensured with the "Natural Disaster Coordination Unit" to be established by the municipality.



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4.2.2. Natural disaster phase (Confrontation) (First 72 hours)

At this stage, the duties and responsibilities of the municipality that need to be done during a natural disaster, especially in 72 hours of vital value, can be summarized as follows;

a. The Natural Disaster Management and Coordination Unit of the relevant Municipality should convene with the relevant managers and decision makers and crisis management organization should be carried out.

Coordination and communication with other relevant units of the municipality's official AFAD and other institutions and NGOs should be ensured.

b. Municipality's "Rescue and Emergency Aid Teams" should participate in rescue and first aid operations.

c. A building damage assessment team should be formed and reports should be prepared.

d. Measures should be taken to ensure the safety of relevant public areas.

e. Necessary measures should be taken for environmental health.

f. Organization of the city's transportation and work vehicles should be made by the Municipality's Public Works Department.

g. Measures should be taken to save human lives and provide treatment as soon as possible.

h. Take measures to protect the lives and property of people affected by the earthquake from new dangers and risks that the earthquake may cause.

i. Necessary work should be done to meet the vital needs of those affected by the earthquake as soon as possible and to ensure that life in the earthquake zone, especially in settlements, returns to normal as soon as possible. For this purpose, people should be placed in city and neighborhood parks and their vital needs (such as vital water, food, clothing, security, heating, lighting, shelter, and protection) should be met.

j. Measures should be taken to prevent secondary disasters such as fire, explosion, infectious diseases, natural gas explosion, and electric shock.

4.2.3. Post natural disaster phase (Recovery):

Municipalities include the process of taking safe measures for accommodation, resettlement, and transition to normal life in the long term within the framework of cooperation and coordination with other stakeholders, especially AFAD.

a. Suitable temporary shelter locations should be identified and infrastructure and superstructure works should be carried out. Campsites such as tents, caravans, and containers should be established. Or they should be placed in intact public buildings or facilities specially prepared for this purpose.

b. Organization of processes for the identification and strengthening of low and medium-damaged structures affected by natural disasters should be carried out. Continue to provide infrastructure such as communication, transportation, water, electricity, sewerage and vital needs such as education, long-term temporary housing, and economic and social activities to return earthquake-stricken communities to normal life.



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c. Reconstruction or repair of all damaged structures and facilities according to their condition and improvement of the deteriorated economic, social, and psychological situation. The reconstruction phase may take several years depending on the magnitude and impact of the earthquake. One of the duties of the municipality defined in the legislation is to determine urban transformation and development areas (at least 5 and at most 500 hectares) and ensure that projects are designed and implemented by the legislation.

d. Identify suitable locations for the accumulation of waste and residues and take measures for their regular transportation.

5. CONCLUSION and RECOMMENDATIONS

These natural processes turn into natural disasters by causing loss of life and property due to reasons such as the fact that the multifaceted activities of people are not compatible with natural processes, people's attitudes and behaviors are not ethical, scientific and technical information is ignored and not applied, especially rent-seeking goals, political pressures and tendencies are at the forefront, damaging approaches and necessary measures are not taken. As a result, a natural disaster is a consequence and is human induced.

In our country, disaster management is managed by the central administration (AFAD). Municipalities have only assumed a support role. However, due to the centralized structure experienced in the disasters, the role or intervention effect of local administrations has been reduced especially in the first critical moments of the disaster phase and afterward, the coordination between the center and local bodies and NGOs has not been established.

For this reason, it should be ensured that technical, managerial, and legal works of local administrations should be organized within a system with the participation of the public to ensure a fast and effective rescue, first aid, temporary sheltering, and reconstruction activities to be carried out during and after the disaster with the measures to be taken before the disaster.

The following recommendations have been developed for municipalities to play a more active role before, during, and after earthquake disasters.

- To ensure governance in the field of Urban Resilience, the leadership of the mayor, institutional capacity to provide accurate and reliable data and implement the decisions taken, research institutions that can conduct the necessary research, sufficient resources to be allocated from the budget, and working groups, volunteer groups and NGOs established in the municipality working in the field of resilience are needed (Meadowcroft, 2011).
- In terms of direct participation mechanisms and "subsidiarity" of local government services within the scope of metropolitan municipalities, provincial municipalities, and district municipalities, issues such as municipal boundaries, general organization, hierarchical relations, spatial organization, definition of services and activities, etc. need to be reconsidered and revised. For example, instead of special provincial administrations serving in rural areas, the structuring of district municipalities to serve not only the center but also the entire district boundary (including villages, sub-districts, etc.) should be open to discussion.
- Municipalities should be given the necessary powers by the relevant ministry regarding earthquake disaster management.



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- The hierarchical powers of metropolitan municipalities over district municipalities lead to the centralization of local governments (Bilgiç, 2009, p.115). This situation is incompatible with the general principles and practices of the European Charter of Local Self-Government. However, it is seen that local governments, which are not under the guidance of the central authority and which have moved away from centralization, meet local needs more quickly and economically and create a much easier and more effective communication ground with the people living locally (Parlak, 2014, p.12-13).
- Article 7 of the Metropolitan Municipality Law No. 5216 and Article 53 of the Municipality Law No. 5393 should detail the powers and responsibilities given to municipalities and, if necessary, an implementation regulation should be published.
- It should become compulsory to establish Natural Disaster Management and Coordination Units in all metropolitan, provincial, and district municipalities. An institutional natural disaster management system should be established in all municipalities. Natural disaster action plans should be prepared.
- Municipalities must create resilient cities. In this context, urban master development plans and policies should be handled and designed with holistic and ecological approaches.
- Urban green areas have a very important strategic functionality before and after natural disasters. For this reason, urban green areas should be organized at the neighborhood scale according to equality, accessibility, aesthetics, and multi-purpose functional features. Urban master and implementation plans should take into account not only social and economic parameters but also natural (landscape) parameters and should be reflected and implemented in the decision-making process.
- Municipalities have the responsibility to prepare and educate the public against natural disasters. For this purpose, disaster awareness training for vulnerable groups and all individuals, especially students, should be made widespread. It will be of great benefit for municipalities to establish disaster training centers within their means.
- To create resilient cities, it will be possible to produce ecological solutions in harmony with nature within the framework of scientific, technical, and ethical principles.

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**NATURAL DISASTER MANAGEMENT GUIDE FOR NURSERY
BUSINESSES**

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ABSTRACT

The ornamental plants sector is the newest and most advanced sector of agricultural production in our country in terms of its scope and production range. The sector includes the production, propagation, growth, and marketing of plants for aesthetic, functional, and economic purposes using different methods. Increasing environmental awareness along with the developing socio-economic structure has increased the demand for ornamental plant production in our country, especially in recent years, and ornamental plant production areas increased 2.5 times between 2002 and 2021. The production areas of the sector consist of very fragmented and small plots of land, as is the case in agriculture in general. Today, the ability of nursery enterprises that produce, grow and market ornamental plants to compete in international markets requires the sustainable production of quality goods and services by standards, and certain plans and programs, in series, with high efficiency, in a sustainable manner. Today, as a result of earthquakes, floods, and other natural disasters, the nursery sector is seriously damaged in many ways. In this context, natural disaster risk and crisis management are required for every nursery business. The study aims to reveal the precautions and actions to be taken in nursery enterprises before, during, and after natural disasters. Thus, it is aimed to create a natural disaster management guide for nursery enterprises.

Keywords: Ornamental Plants, Nursery Businesses, Natural Disaster Management, Risk and Crisis Management.

1. INTRODUCTION

Ornamental plants can be defined as plants that are produced, propagated, and grown for aesthetic, functional, and economic purposes using different methods. As can be understood from this definition, ornamental plants are a sector with a very wide scope and production range. This sector expands its foreign trade volume every year depending on agricultural and sectoral developments.

In addition, in terms of cultivation and production activities, our country has important advantages such as its ecology and natural assets, suitable climatic and geographical conditions, proximity to market countries, and cheap labor force.

As stated in official sources, although ornamental plant production areas increased 2.5 times between 2002 and 2021, the sector needs more production areas to reach its target.



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In Türkiye, flowers are produced in an area of only 300 ha. Istanbul, Bursa, Yalova, Izmir, Muğla, Samsun, Samsun, Trabzon, Ankara, Kırşehir, Antalya, İçel, Adana, İskenderun, Erzurum and Diyarbakır are among the provinces that have an important place in ornamental plant production.

As in agriculture in general, the production areas of the sector consist of very fragmented and small plots. Ornamental plants are produced in 55 provinces in Türkiye. The provinces with the highest production are İzmir, Sakarya, Yalova, Antalya, Bursa, and İstanbul.

Located in 3 different geographical regions, the production areas of private and public subsidiaries are within the scope of the 1st and 2nd disaster zones in terms of earthquakes and other natural disasters. Due to its tectonic, seismic, topographical and climatic structure, Türkiye is frequently exposed to natural disasters and ranks third in the world in terms of earthquake-related deaths and eighth in terms of those affected (AFAD) (Figure 1).

Although disasters have multidimensional and negative consequences at the global level, the proportion of scientific publications on disasters at the global level in the period 2012-2016 constituted only 0.22% of all academic publications and scientific publications on disasters and their consequences are mostly produced by developed countries (USA, UK, China, Japan) and certain countries (Kiprop, 2017). In most countries that are greatly affected by disasters, including our country, scientific studies in this field are almost non-existent.

Therefore, in these regions where such enterprises are located, it is imperative to create a guide on all measures and behaviors that should be applied and/or taken in disaster situations.

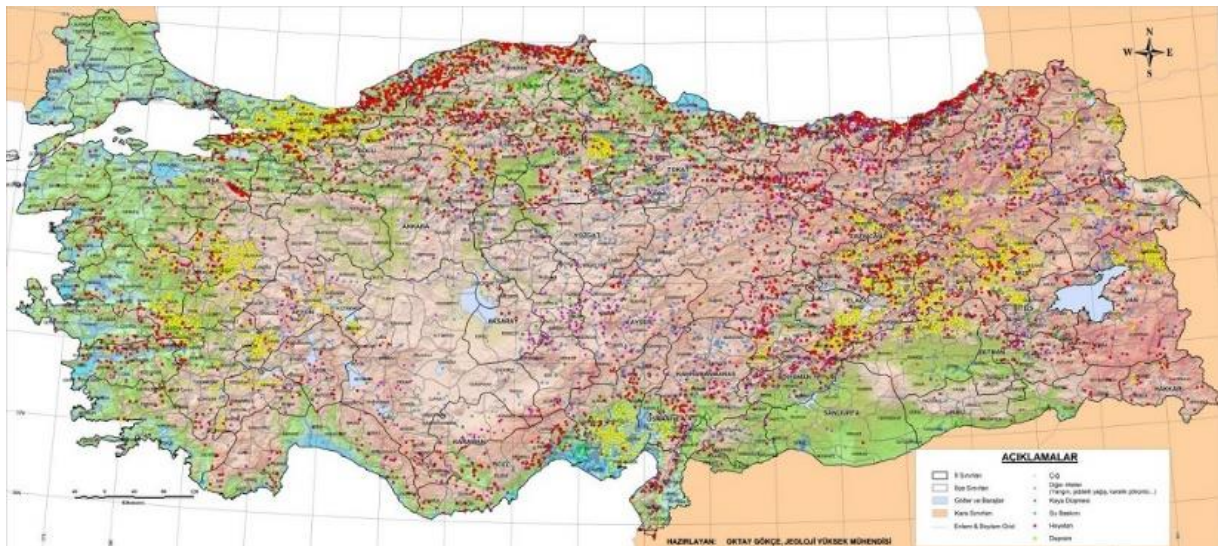


Figure 1. Map of Türkiye's disaster zones (URL.1)



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2. METHOD and MATERIAL

The damages and losses caused by disasters are multi-dimensional. Apart from human losses, disasters pose a serious risk to global development. Disasters, which damage the physical environment and infrastructure, also destroy the environment and ecosystem, create a wide range of negative impacts on services and products, and have consequences such as economic crises, and political and social problems. In developing countries, 85% of the population is vulnerable to the effects of disasters such as earthquakes, floods, and droughts (Kuterdem & Akın, 2011).

Our country has important advantages such as its ecology and natural assets, suitable climatic and geographical conditions, proximity to market countries, and cheap labor force. It will be possible for these advantages to turn into added value and for the sector to reach the place it deserves in the world market with the solution to some existing problems. Environmental awareness in growing and developing cities has led to an increase in the production of ornamental plants in proportion to the demand in our country, especially in recent years. The main purpose of this study is to create a Natural Disaster Management Guide for Ornamental Plant Nurseries.

As a result of natural disasters, there is an urgent need to determine the damages on ornamental plant production lands and to make land plans for the new production period.

Since the existing enterprises and the lands belonging to these enterprises in the provinces where ornamental plant cultivation is widespread in our country are locations within the scope of serious natural disasters, especially earthquakes, floods, fires, and droughts, a field study was created based on the enterprise structures, land conditions, and environmental factors in these regions and options and suggestions that can be taken against natural disasters were prepared.

The land and distribution conditions of the enterprises located in Antalya, Bursa, Istanbul, Yalova, and Sakarya were examined and recorded.

It should be determined within the scope of which disaster the enterprises and land structures in the regions declared as natural disaster zones should be prioritized. Disaster zones are the regions that are seriously affected by the negative consequences of the disaster and that occur naturally without the requirement of declaring a "Disaster Zone" when urgent help is needed by the authorities (Ergünay, 2002).

- Businesses located in Istanbul-Earthquake, Flood, fire
- Businesses located in Izmir-Earthquake, Extreme precipitation (flood, erosion, landslide, drought, Fire
- Businesses located in Antalya - Strong Winds (storm, tornado, etc.) Excessive precipitation (flood, erosion, landslide), Fire, Drought,
- Bursa-based businesses - Earthquake, Fire, Flood
- Businesses residing in Sakarya - Earthquake, Fire, Flood.



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2.1. Natural Disaster Management in Nursery Enterprises

In the "Annotated Glossary of Disaster Management Terms" prepared by AFAD, emergency planning is defined as "all activities that require timely, rapid and effective implementation of the works and procedures that need to be carried out to save human life and property and other activities from the consequences of extraordinary events with minimum loss and damage, before the events occur and during the event". According to the Regulation on Emergency Situations in Workplaces, an emergency plan is a plan that includes information and practical actions, including the work and procedures to be carried out in emergencies that may occur in workplaces. The occupational health and safety management system is a tool used to address OHS activities systematically in line with the general strategies of organizations and to solve them within the framework of a continuous improvement approach. One of the sine qua non under the occupational health and safety management systems established in workplaces is the emergency heading. Disaster Management Processes for natural disasters in nursery enterprises should consist of 3 stages.

- a. Preparation and planning phase,
- b. The stage during the disaster,
- c. Improvement and renewal phase.

a. Preparation and planning phase

The disaster management system being implemented in our country has been determined by the Law No. 7269 "Law on Measures to be Taken and Assistance to be Provided in Case of Disasters Affecting Public Life" enacted in 1959 and repealing the Law No. 4623. Under the 4th article of this Law, with the decision of the Council of Ministers dated 01.04.1988 and numbered 88/12777, how to be organized both in the centers and in the provinces and districts and the duties, authorities, and responsibilities of the institutions within the disaster response system and the principles of planning and preparation have been determined. In this context, the "Central Coordination Board for Disasters" is chaired by the Undersecretary of the Ministry of Public Works and Settlement with the participation of representatives of all existing ministries, Red Crescent, and Turkish Armed Forces (İTÜ, 2002).

*An Emergency Action Plan should be made before the disaster to prepare for disasters and to be able to respond to disasters in a timely, fast, and effective manner. It should be revised every 2-3 years.

*Risk areas and impacts in the area should be determined. Possible natural disasters should be identified.

*Early warning systems should be established.

*Emergency aid material supply and stocking should be done,

*Personnel drills for natural disasters should be conducted.

*Information and awareness raising and training activities should be carried out.

*Insurance for natural disasters should be made.



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First of all, enterprises and land structures where existing ornamental plants are produced should be evaluated within the scope of natural disasters and survey studies should be carried out.

*They should be redesigned to be minimally affected by natural disasters.

*Buildings and settlement areas should be constructed according to the land structure of the enterprises located especially in earthquake zones, standardization should be made in the building materials used, and opportunities for the use of light materials should be provided.

*Buildings and construction structures of ornamental plant production closed areas and enterprises, especially in regions and provinces with excessive rainfall, should be constructed in such a way that they are minimally affected by storm, flood, erosion, and landslide disasters caused by rainfall.

* If possible, construction and installation should not be carried out on lands with topographical conditions (such as slope, aspect and loose slope soil parent material) in the locations where the land is deployed, and redesign and strengthening works should be carried out according to such disasters.

*Most of the production structures and lands of the nursery enterprises in our country are located in locations where drought and consequently fire hazards can be seen intensely. The areas where production facilities are located should not be located in forest lands.

*The usage status and location of the personnel and all kinds of necessary materials used in the facilities should not be positioned in a way to trigger fire and similar natural events, especially in summer months.

*Personnel working in agricultural enterprises should have the knowledge and know-how to know and apply the behaviors they should do in case of natural disasters. For this purpose, regular training regarding all kinds of activities and actions should be provided.

b. Phase during a disaster

Emergency aid includes rescue of disaster victims, first aid and medical treatment to the wounded, temporary accommodation of hungry and exposed families, and provision of food, clothing, heating, lighting, and other necessities and aid to prevent epidemics (Resmi Gazete, 08.05.1988).

No matter how big the dimensions of the danger during the disaster, the higher the power of the society to resist and show resistance against the effects of the disaster, the less the effects of the disaster will be. In short, the smaller the capacity of society to cope with the consequences of the hazard, the more effective it is in the disaster (Ergünay, 2002).

*Intervention,

*Rescue of life and property in disasters and emergencies,

*Health,

*Nutrition,

*Housing,



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- *Security,
- *Property and environmental protection,
- *Social and psychological support
- *Evacuation,
- *Efforts should be made to provide temporary settlement services.

Since all activities to be carried out during a disaster aim to use all powers and resources of the state in the disaster area in the fastest way and with effective methods, they require very good coordination and extraordinary preparations, authorities and responsibilities needed to be applied under extraordinary conditions (Özmen et al., 2005).

2.1.2. Improvement and renovation phase

The main objective of the activities carried out in this phase is to carry out all necessary activities to meet the minimum level of vital activities such as communication, transportation, water, electricity, sewerage, education, long-term temporary settlement, economic and social activities, etc. of the disaster-stricken communities.

These are all activities that start immediately after the occurrence of a disaster and may last for several years depending on the magnitude of the damages caused by the disaster.

Providing vital needs such as communication, transportation, water, electricity and sewerage rapidly.

Determination of post-disaster losses and initiation of the necessary process for payment of damages according to the legislation.

3. CONCLUSION and RECOMMENDATIONS

Earthquake Zones Map"; Approximately 96 percent of the country's territory is at risk of earthquake zones. 98 percent of the population lives in these regions. According to TUIK 2022 data; 3.8 million hectares of the 23.8 million hectares of agricultural land in Türkiye are in the earthquake zone. In Türkiye, 16 percent of agricultural product areas and 10 percent of meadow/pasture areas are in the earthquake zone (Figure 2).

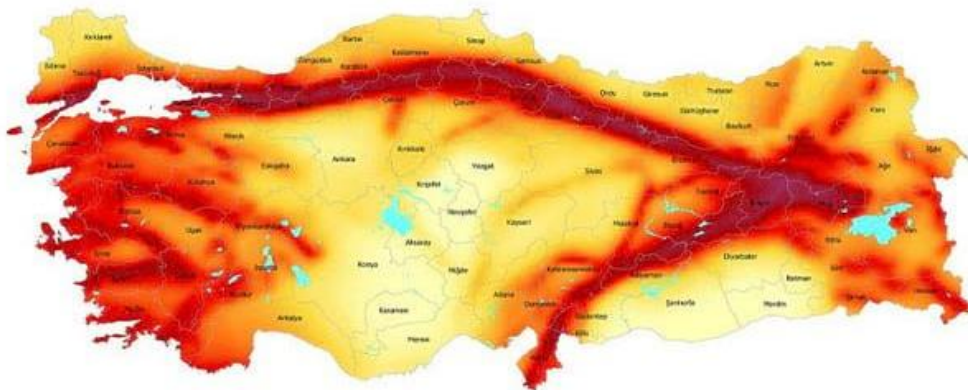


Figure 2. Türkiye earthquake zones map (URL, 2)



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In our country, whether natural, technological, or human-induced, the practices of taking measures to reduce the damages of major disasters, whether natural, technological or human-induced, are predominantly intervention and disaster damage reduction measures to be applied after the emergencies occur rather than taking measures to reduce the damages of major disasters with planning to be done in advance (ITU, 2002). This leads to wounds that cannot be repaired both materially and spiritually after the disaster. In other words, it is necessary to give importance to risk management and adaptation studies as in developed countries in disaster management (Özden et al., 2008).

The commercial nursery sector started in the 1940s and ornamental plants are produced in a total of 20 provinces in Türkiye. Thus, it has become a sector that contributes significantly to the economy of the country. It is imperative to determine the possible risks and take precautions for all kinds of natural disasters in Nursery Establishments. For successful disaster management, it is possible to carry out "pre-disaster preparation", "response" and "recovery" processes for risk reduction and increasing resilience much more successfully. Information and awareness-raising activities against natural disasters should be carried out continuously and the issue should always be on the agenda.

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THE ADVANTAGES OF USING BIODEGRADABLE AND ECO-FRIENDLY MATERIALS IN CONSTRUCTION

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ABSTRACT

In recent years, the construction sector has started to prefer more sustainable applications. As a result of these approaches, studies are carried out on more efficient use of resources, human and environmental health, energy efficiency, reduction of carbon footprint and reduction of the impact of construction and demolition wastes on the environment. As a result of these studies, biodegradable and environmentally friendly materials come to the fore. Biodegradable materials are substances that dissolve naturally without leaving pollution and toxic effects. Materials such as bamboo, cork can be given as examples. Through these sustainable materials, the carbon footprint of the building can be reduced and less waste can be generated during the construction process. By choosing these materials, the energy, resources and cost spent to produce traditional construction methods (steel, concrete) can be reduced. The benefits of using biodegradable and environmentally friendly materials in construction are that they are sustainable and renewable, as well as adding aesthetic qualities to the building. At the same time, it can be more convenient than traditional methods and cause more efficient use of materials. Architects, engineers and construction sector employees should learn the properties and usage techniques of these materials and be more conscious. The aim of this study is to review the existing literature on the use of eco-friendly and biodegradable materials in construction and to evaluate options for integrating biodegradable materials into the construction industry. Thus, by designing biodegradable building materials through eco-friendly buildings, it is aimed to reduce viable and significant waste in residential construction.

Keywords: Biodegradable Materials, Ecological Materials, Construction, Eco-Friendly Material.

1. INTRODUCTION

Eco friendly is simply defined as not harming the environment. Biodegradable is to be able to decay naturally and in a non-harmful way. There has always been a need for shelter since humanity existed. As material technologies develop, eco-friendly and biodegradable materials have become more important than traditional materials (concrete, steel, etc.).

In recent years, the construction sector has started to turn towards sustainable practices. As a result of this orientation, the use of biodegradable and environmentally friendly materials has started to increase. Research and development studies on this subject have gained momentum. In this study, some of the biodegradable and ecological materials were investigated.

2. BIODEGRADABLE and ECOLOGICAL MATERIALS

Bamboo

Bamboo, from the botanical name 'Bambusa', heavy rain suitable for growing in climates with lots of sun and high CO₂ levels (Kampinga, 2015). A bamboo grove or plantation is also a refuge for birds and many other creatures (Janssens, 2000).

This fast-growing plant was a building material used by mankind for shelter in the past (Figure 1). Today, it is still used in simple structures and different architectural structures are designed especially with the development of technology (Figure 2). As Janssens (2000), bamboo has the remarkable ability to create an "ambient", in the artistic sense of the term.



Figure 1. Traditional Bamboo House with man smoking inside, (Flores-Guevara & Lon, 1995).

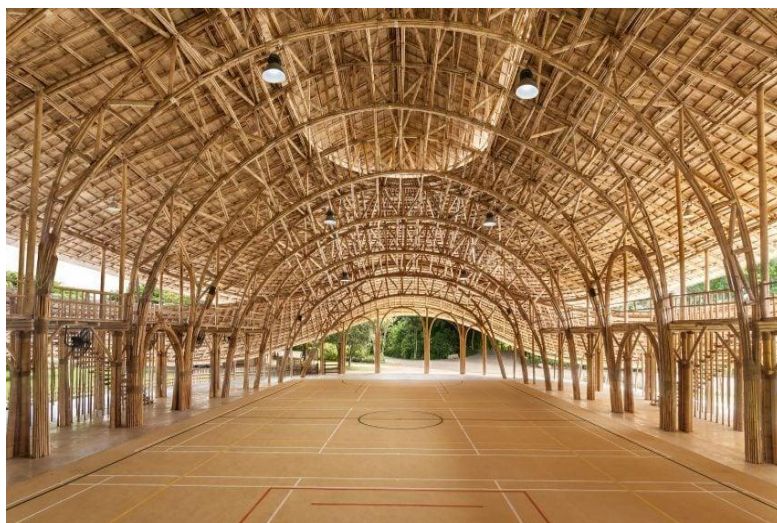


Figure 2. Bamboo Sports Hall (Chiangmai Life Architects and Construction, n.d.)



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Today, bamboo is used not only as timber but also as building material in various forms. Biocomposite materials such as bamboo medium-density fibreboard (MDF), flakeboard, plybamboo, inorganic cement board have been developed.

The advantages of bamboo are eco-friendly material, light, strong and versatile properties, fast growing and highly productive, and most importantly, self-renewing resource (Sharma, Dhanwantri & Mehta, 2014). Besides these benefits, there are also some disadvantages. Bamboo is subjected to attack by fungi and insects; for this reason, untreated bamboo structures are viewed as temporary with an expected life of not more than 5 years. Therefore, it requires preservation. In terms of joints, although many jointing techniques exist, their structural efficiency is low. And also, there is lack of design guidance and codes (Sharma et al., 2014).

The International Organization for Standardisation (ISO) has established a standard, ISO 22157, for the use of this product as a building material. This standard specifies test methods for mass per volume, moisture content, compression, shrinkage, shear, bending and tensile strength of bamboo. These methods determine the characteristic physical and strength properties. It is predicted that with the increase in research and the development of production methods, the disadvantages of bamboo can be eliminated.

Cork

The cork that we know from wine bottles is extracted from the bark of the cork oak tree (*Quercus suber* L.) (Pereira, 2007). Cork is a closed-cell foam composed by tiny hollow cells of hexagonal prismatic (Pereira, 2007) (Figure 3). It is an eco-friendly and sustainable material not only for how it is harvested, but also cause it is recyclable, or comes from renewable sources, and is biodegradable. You can use every piece of cork several times and this 100% natural element is great for insulating and last for years (Teka, 2019).

Cork is a very cheap material and can be used for without a big budget (Teka, 2019). Cork is one of the most versatile materials. It is a natural material that can be used in many areas, such as as an insulating material in construction, as a wine bottle cap, complex structures under vibration and dynamic loads are examples of their high-tech applications. As it is composed of air-filled cells, it is an excellent thermal and acoustic insulator (SPD UK, n.d.; Pereira, 2007).



Figure 3: Cork Panel (Wikipedia, n.d.)

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Desert Sand

As it is known, non-renewable energy resources in our world are limited and are consumed rapidly. Global desertification is one of the most important concerns of today and future. For these reasons, desert sand, which is almost endless, can be an alternative building material and research on this subject continues.

In the study conducted by Chen et al. (2022), they produced building materials from desert sand with a solar-powered 3D printer. In this way, it can effectively alleviate the shortage of raw materials and high energy consumption during the construction material production stage, which can contribute to cleaner production. As a result of the experiment, 3D-printed samples showed compressive strengths of 62.05 ± 8.02 MPa and thermal conductivities of 1.069 ± 0.018 W/m·K, which meet the requirements of building materials (Figure 4).



Figure 4. Result of a mortise-and-tenon joint, (Chen et al., 2022)

Bioplastic

With the continuous increase in plastic consumption in the world, plastic pollution is constantly increasing. Developed environmentally friendly bioplastics dissolve in nature without causing pollution. Due to this feature, it is defined as a biodegradable and environmentally friendly material. In the coming years, it is predicted that its use in areas such as building materials, joints, etc., especially in the construction sector, will increase gradually.

Bioplastics are made wholly or in part from renewable biomass sources such as sugarcane and corn, or from microbes such as yeast. Some bioplastics are biodegradable or even compostable, under the right conditions. Bioplastics made from renewable resources can be naturally recycled by biological processes, thus limiting the use of fossil fuels and protecting the environment (Ashter, 2016). An additional problem with petroleum-based plastics is that petroleum resources are being used up; conservative sources estimate that at current rates of consumption, all known sources of petroleum on Earth will have been depleted before the end of the 21st century. Petroleum is a non-renewable resource. Today, it is used in many areas and is rapidly depleting. Considering the impact of petroleum-based plastic wastes on the environment, bioplastics are becoming important in this regard, especially since modern life is dependent on plastic (Fridovich-Keil, 2023).



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3. RESULT and CONCLUSIONS

The resources in our world are limited and increasingly depleted. For this reason, it is important for resources to be more efficient, environmentally friendly and sustainable. For this reason, the use of nature-friendly and biodegradable materials will become more important in the future.

Environmentally friendly buildings can come to the fore by using bamboo. Biodegradable building materials can also be made from bamboo. Excellent heat and sound insulation, waterproof, nature-friendly and biodegradable building materials made of cork can be produced for use in our homes.

Through bioplastics, the consumption of petroleum-based plastics can be reduced, and thus, materials that pollute the environment less and dissolve in nature can be developed. And also entrepreneurs should be supported for the development of new biodegradable and nature-friendly building materials.

People should be encouraged to use ecological and nature-friendly products and their awareness should be raised.

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URBAN STREET IMAGEABILITY IN MANAMA OLD TOWN, BAHRAIN

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ABSTRACT

Urban Design Quality Assessment has been developed as an important approach for the study of urban quality with several criteria and measures. This research used Imageability for the assessment of urban design quality in the streets of old Manama, the capital of the Kingdom of Bahrain. It has been going through many developments that brought many changes to the urban quality of the city. These developments have been mainly concentrated in the northern part of the city giving it a new modern character. Old Manama, on the southern side of the new city, kept its traditional urban structure. There is always a need to study the quality of urban design in such situations to understand the relationship between traditionality and modernity, and continuity and change. The assessment depended mainly on a field survey of some streets with observation and photographing. The photos then were analyzed to explore the quality Imageability through these streets. The research shows that Imageability has distinguished aspects in old Manama but still there is a need for improvement. This research also highlights the subjectivity and inaccuracy of using such criteria and measures for the study of urban character and still there is a lot to be done to improve these criteria and tools.

Keywords: Urban, Quality, Assessment, Imageability, Manama, Bahrain.

1. INTRODUCTION

What is Imageability?

Human beings are space-time sensitive. People are usually affected by the spatial and temporal settings within which they live. Events and activities through time form history and the spaces where they take place are part of it. Generally, this is the life of people inside their cities. City space is part of life perception and its image affects the way people look at the city. This perceived image is important for connecting people to their city and making them closer to it and feel belonging to it. How much this image is smart, bright, and beautiful, people will feel closer to their city and feel a stronger connection and belonging. Such a distinguished image will remain imprinted in the cognition of people and will not be forgotten. This is one side of Imageability (Cox, 2022).

Imageability is seen by Hasan et al. (2022, p. 5) as “a word that means the physical features of an urban design that define its uniqueness within its environment, a sense of place that permits its inhabitants to define it, and an aspect in determining the quality of space by eliciting powerful, lasting memories. The capacity of any physical thing to elicit a solid image for any particular observer by presenting instrumental and relevant mental pictures or patterns.”

It is the quality of the city that makes it clearly and cleanly loved, respected, and remembered by its people (Meenar et al 2019). It is the distinguishing elements of the city and their amazing characters. It is the urban design sense of these elements and their visual and aesthetical quality that give quality to the built environment (Ernawati, 2021). The image of the city is composed of the different elements of the physical urban structure of the city. Kevin Lurch definition of



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these elements includes districts, nodes, monuments, movement spaces, and landmarks (Lynch, 1960). The level of clarity and simplicity of understanding of these elements and the images they form is the legibility quality of the urban structure of the city. It is also important here to notice that this image not only depends on the quality of the physical environment of the city but also depends on its historical, cultural, and meanings values of society (Jiang, 2012). Imageability therefore is an important quality that is needed to exist in the city to provide comfort, satisfaction, and happiness for the people. These considerations should start from the initial planning stages of the city and its development through the details of its urban design elements including street facades, street furniture, street pavements, and softscape and hardscape elements (Alamouch and Kertesz, 2022). This is in addition to the design of its urban spaces and their contents and the type of activities and functions that they have. Urban design elements and principles play a vital role in the creation of the image of the city. The design of the different elements that compose the urban structure of the city applying order, proportion, rhythm, scale, and other visual design principles is needed. Taking care of the elements of form like color, texture, material, size, and volume is also important. The functions, activities, and overall aesthetical quality of the city and its elements also play a crucial role in the creation of good urban design quality of the city. Imageability makes people feel at home in their city, it is theirs, they know it, feel it, and love it, and within it, they cooperate to take care of it and keep it alive. The image of the city with all its 3 components strengthens the sense of community involvement and belonging (Russell and Sullivan, 2020).

Urban street Imageability

Imageability should be observed in all parts of the urban structure of the city. Streets provide great opportunity for expressing and experiencing the urban qualities of the city including imageability. They are considered the most important open public space in the city. They are where a large amount of livable functions and activities exist such as shopping, entertaining, dining, walking and socializing. (Wan Ismail et al, 2018) argue that streets are important tools for recording and determining the history of the city and its inhabitants and the development of its several structures. The street is not the 2-dimensional space of the pavement where people walk. It is the 3-dimensional space enclosed by the buildings on its 2 sides in addition to the ground plan of the walking pavement. The sky view above is also part of the urban street (Abd Rahman, et al, 2019).

The street as an urban entity has 3 components. First, the tangible part of the physical environment which is composed of the buildings and urban spaces along the street with all their design elements and design principles. These are the main elements that form the visual and aesthetical qualities of the street. Second, the intangible part includes land uses, functions, and activities that exist in the street and give it its social, economic, and cultural identity. Third, there is the perceived image of the street according to the experience of its users and their assessment of its tangible and intangible components. According to this perception, the street will be considered a livable, vibrant, and attractive space that makes its users satisfied and happy. Or it will be considered as an unattractive and unsatisfactory space. As such, the street is a sensitive parameter of the quality of life in the city. It is the vein that circulates the life currents in the city and keeps it alive. Empty streets are nothing but parts of a dead city. (Alamouch and Kertesz, 2022).

Streets strongly connect to the cognitive image people hold for their city. They are the main elements that give form and character to the urban structure of the city. Not only as physical



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spaces but also as functions and activities spaces. People usually give names to their streets according to their functions or activities or relating to cultural, economic, or historical factors, neglecting the names given by the municipality. It is the meaning of the street and the feelings that it generates that are more connected to its value and quality for its people (Cox, 2022).

2. MATERIAL and METHOD

Measuring Urban Street Imageability

Several studies provided different approaches, methodologies, indicators, and measures for the assessment of Imageability. Since 2005 Reid Ewing and several of his colleagues worked on identifying and measuring urban design qualities in urban streets (Ewing et al., 2005, 2006; Ewing and Handy, 2009; Ewing and Clemente, 2013). The result came with 8 measures for Imageability as they are illustrated in (Table 1). Ernawati (2019) listed 10 indicators that can be used to measure the Imageability of a historic street and its influence on people's preference. In their study for Imageability of the slum area of Mojo Village, Surakarta City, Indonesia Albarqi et al (2022) identified 5 variables, 17 indicators, and 25 measures. They mainly depended on the works of Ewing R. et al. Although the above review is not an extensive one, it shows that the measures of Ewing R. et al are the clearest and simplest ones. They are used in a large number of studies on the assessment of urban design qualities of urban streets. They will be used in this research for the analysis of the urban streets of old Manama.

Table 1. Variables, indicators, and measures of imageability

Reference	Urban environment element	Indicators	Measures
Ewing, R et al 2005, 2006, Ewing and Handy, 2009, Ewing and Clemente, 2013).			<ol style="list-style-type: none"> 1. The number of courtyards, plazas, and parks on the block face 2. Number of major landscape features visible from the block face 3. Proportion of historic building frontage (both sides) 4. Number of buildings with identifiers (both sides) 5. Number of buildings with nonrectangular shapes 6. Presence of outdoor dining (observer side) 7. Number of people (observer side) 8. Noise level
Ernawati, J. 2019.		<ol style="list-style-type: none"> 1. Pleasantness 2. Clarity 3. Impressiveness, 4. Remembrance of the past 5. Unforgettable memory 6. Uniqueness 7. Attractiveness 8. Distinctiveness 9. Recognizable quality 10. Memorableness. 	



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Albarqi et al 2022	Public Open Spaces	<ol style="list-style-type: none"> 1. Courtyard 2. Plaza 3. Park 4. Garden 	<ol style="list-style-type: none"> 1. Open space is very active, has a local character, and complete street furniture. 2. Active open space has a particular character, complete street furniture. 3. The open space is active, does not have a particular character, and the completeness of the street furniture is sufficient. 4. Open space is not active, has no character, and minimal street furniture. 5. Abandoned open space (not designed), has no character, no street furniture
	Major landscape features	<ol style="list-style-type: none"> 1. Riverbanks 2. Embankment 3. River bridge 	<ol style="list-style-type: none"> 1. Landscape elements are very well designed, and have a local character. 2. Landscape elements are well-designed and have a specific character. 3. Landscape elements are handled quite well but lack a specific character. 4. Landscape elements are not well managed, and have no character 5. Abandoned (not designed) landscape elements, characterless
	Outdoor dining	<ol style="list-style-type: none"> 1. Food stalls 2. Angkringan 3. Cafe 	<ol style="list-style-type: none"> 1. The food stall has a local character, neat and well-maintained. 2. The food stall has a particular character, is neat and well-maintained. 3. The food stall does not have a specific character but is neat and well-maintained. 4. The food stall has no character; it is neat but not maintained. 5. The food stall has no character, is untidy and unkempt
	Buildings with non-rectangular silhouettes	<ol style="list-style-type: none"> 1. Buildings with trapezoid silhouettes 2. Buildings with triangle silhouettes 3. Buildings with circular/curve silhouettes 	<ol style="list-style-type: none"> 1. Buildings with regular shapes, clear styles, well-maintained buildings, with local characteristics 2. Buildings with regular shapes, clear style, well-maintained buildings 3. Buildings with regular shapes, clear style but not well maintained. 4. Buildings with irregular shapes, unclear style but well-maintained 5. Buildings with irregular shapes, unclear style, poorly maintained buildings
Buildings with identifiers	<ol style="list-style-type: none"> 6. Residential 7. Commercial 8. Office 9. Worship 	<ol style="list-style-type: none"> 1. Buildings with permanent signage, distinctive character, clear and neat 2. Buildings with permanent signage, clear and tidy 3. Buildings with permanent signage, clear but untidy 4. Buildings with temporary signage, clear but untidy 5. Buildings with temporary signage, unclear and untidy 	

Area of the study

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The study area is in Manama, the capital of the Kingdom of Bahrain, opposite the eastern coast of the Saudi Arabia (Figure 1).



Figure 1. Map of the Kingdom of Bahrain. (<https://www.worldatlas.com/maps/bahrain>)

Manama is a vibrant city with a distinguished urban form and structure. This is in addition to its interesting mixture between the old development and the new development in a harmonized and integrated organic structure (Figure 2).



Figure 2. Old And New in Manama. (<https://depositphotos.com/photos/manama-bahrain-skyline.html>)

The new spread northwards over reclaimed land and followed postmodern and high-tech architectural styles. The old town remains the hub of busy economic, cultural, and economic life preserving its traditional conservationist style. The streets of the new development are modern, wide, tidy, and car-oriented, while the streets of the old town are narrow, crowded, and pedestrian oriented. Streets of the new development are giant spatial compositions with the high-rise towers enclosing their sides, but the streets of the old town are small to medium size spatial enclosures with low rise and medium rise buildings. Figure 3 shows the boundary of the study area. It is bordered from south and east by Isa Al Kabir av. and Shaikh Mohd Street. From the west there is Al Lolo Road and from the north Government av. in addition to its strategic location, the area are important monuments like Bahrain post building and Bab Al Bahrain at

Government Av. It has distinguished landmarks like Az-Zamil tower and it has important religious buildings like mosques and Matams.

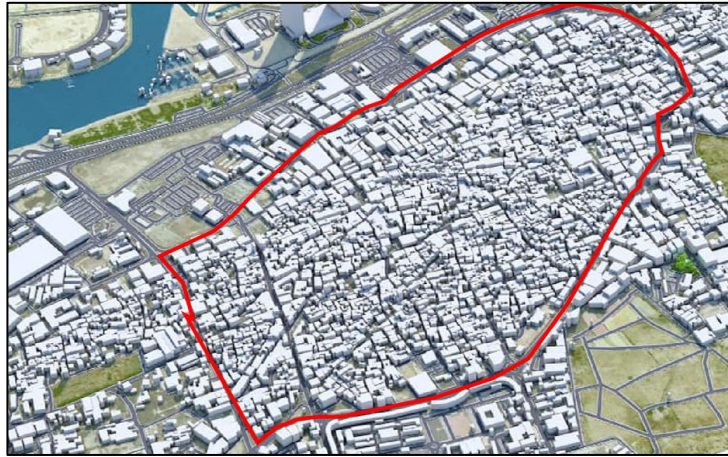


Figure 3. Area of Study in Manama Old Town
(<https://www.renderhub.com/3dstudio/manama-city-bahrain-3d-model-30km>)

Methodology

This research outlines an Urban Design course exercise that was given to the the students of the Department of architecture, University of Bahrain. The aim was to train the students to link the theoretical concepts, theories, and principles of urban design to the life realities in the urban structure of the city. students were introduced to the concept of measuring urban design qualities in the built environment and the different theories and principles of the subject. For simplicity and practicality of conducting the field study, students were directed to follow the The Illustrated Field Manual for Measuring Urban Design Qualities of Ewing et al (2005). 20 Suitable streets were chosen in the area of study (Figure 4) and each street was given to a group of 4 to 7 students.

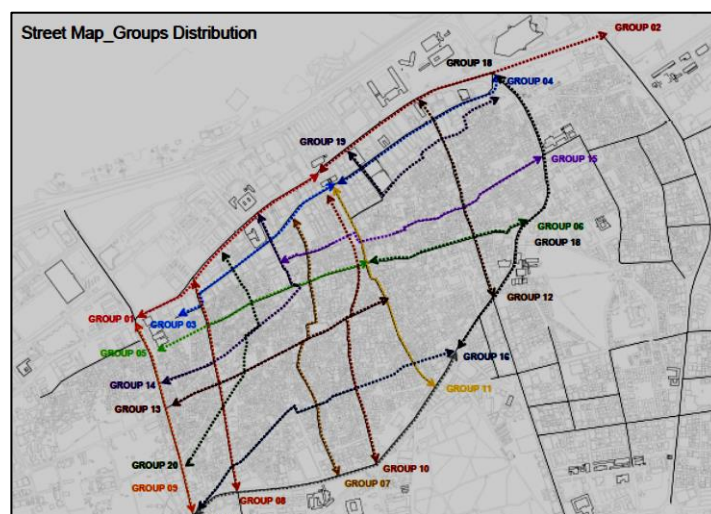


Figure 4. Area of Study in Manama Old Town Showing the Studied Streets.

Students visited the streets themselves and documented the urban design qualities of the streets with their impressions. 5 urban design qualities were studied including Imageability which is

considered in this research. Imageability of only street No. 13 is presented in this article. The segment studied starts from its crossing with Bab Al-Bahrain Avenue at east, then passing the grand mosque of Shaikh Ali Bin Khalifa and ends at its crossing with Al-Lulu street at west, (Figure 5).

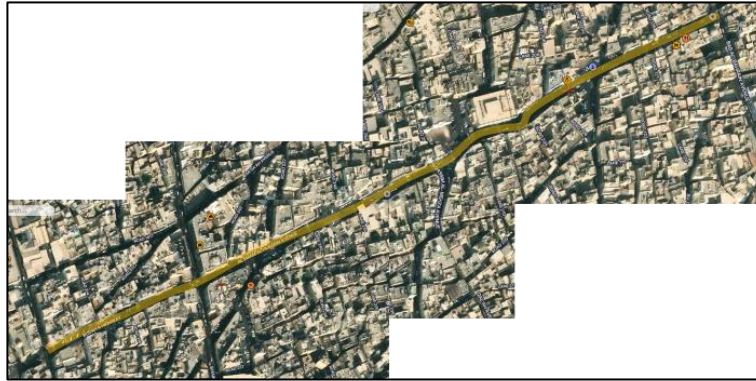


Figure 5. Area of study in Manama Old Town showing the studied streets.

The street is a vibrant urban street open for private car movement. It has a variety of land uses mainly residential in addition to religious like Mosques and Matams. Ground floors are mostly for commercial use. The height of buildings ranges from 2 to 5 floors (Figure 6).

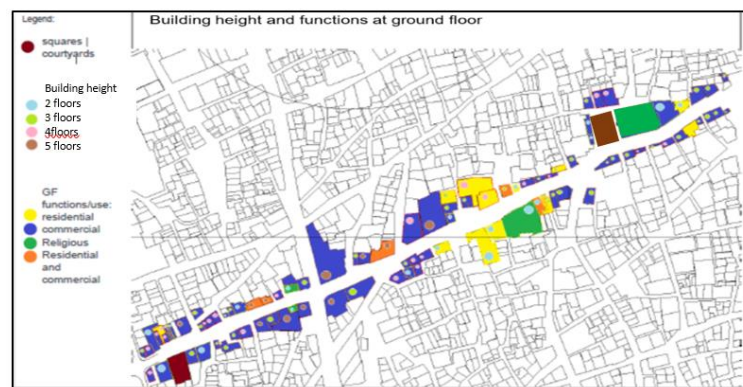


Figure 6. Map of The Street With Land Uses and Building Height.

Imageability Survey of the Street

The analysis depends on the mere assessment by the students themselves. No questionnaires were used for the general public assessment and no expert professionals were consulted as to the original manual of Ewing et al (2005) recommend.

Courtyards, Squares and Parks

Few little squares scattered along the street the largest and most significant of them are Shaikh Ali bin Khalifa Mosque square (Figure 7) and the squares of Matam Bin Saloom and Matam Bushri (Figure-1). No courtyards or parks exist in the street.



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Figure 7. Shaikh Ali bin Khalifa Mosque square



Figure 7-1. Matam Bin Saloom and Matam BuShri (last right) squares.

Major Landscape Features

The street only has 2 palm tree and few other perennial trees (Figure 8).

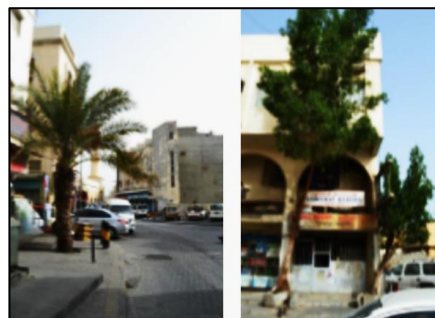


Figure 8. Palm trees and other perennial trees in the street.

Proportion of Historic Buildings

It is believed that many historical buildings exist along the street. Some of them are shown in (Figure 9) depending on subjective judgement of their style and form. To determine their exact number there is a need for careful inspection and referencing.



Figure 9. Buildings Believed to Be Historical in the Street.

Buildings with Identifiers



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Generally, all buildings have clear, large and colorful signs since the street is a busy commercial street (Figure 10). Few buildings have special architectural identifiers as part of their form and structure like the minarets of mosques (Figure 10-1).



Figure 10. Buildings with to Identifiers.



Figure 10-1. Minarets of Mosques as Special Identifiers

Buildings with Non-Rectangular Shapes

Non-rectangularity is not common in such traditional quarters. Few buildings have small round corners or small round façade of a staircase. Few other buildings especially mosques and Matams have arched windows in addition to the domes on their roofs (Figure 11).



Figure 11. Buildings with round corners and staircases. Far right shows arches on the façade of Matam.

Outdoor Dining

The street has many cafeterias and small restaurants but without outdoor dining.

Pedestrian Count

The number of people in the street had 4 pedestrian counts at 4 different times Figure. The result is shown in (12 Figure).



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Figure 12. Pedestrian counts in the street.



Figure 12-1. Pedestrians in different parts of the street.

Noise level

Noise was observed without any technology or instruments in the street at different times and places. The results are shown in (Figure 13).

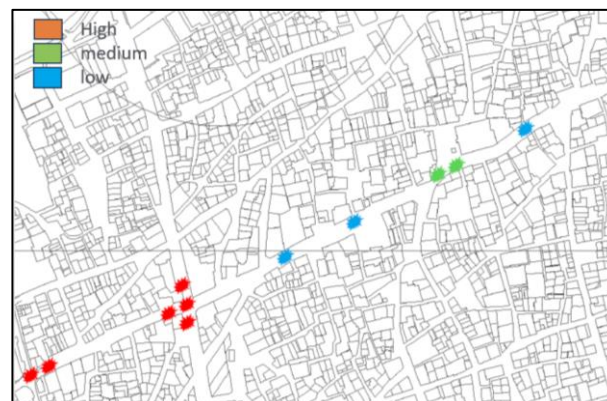


Figure 13. Observation of noise level generally in the street.

Analysis

The survey was a very interesting exercise with the participation of more than 100 students. The many discussions with the students on the routine of the survey and the results brought up these valuable thoughts. The area of study represents the heart of old Manama and the most compact area in terms of its urban structure (Figure 3). It is clear from the aerial photos that the area lacks any sense of real urban space or green structure. The street example considered is in the middle of the area and it has the same problem. The lack of green spaces, courtyards and



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green elements was not the result of ignorance or lack of knowledge. It is the result of many important factors like environmental because of the harsh weather of Manama and the need for compact design to mitigate its effects. There is also the social factor where kinship played a major role in bringing relatives to live close to each other in the same quarter. This is in addition to the economic factor where the early days of Manama did not have much wealth. People have been living with this situation for many years feeling happy and proud of their town. The development of the town faced other problems like the expansion of northward over reclaimed land. This was because of the difficulty of redeveloping the existing areas to the south with their ownership and construction problems.

If the existence of historic buildings is a sign of good urban quality, then the area of study and the street example score very high due to the high historical value they have. Yet this cultural value collides with the need for the rehabilitation of the area. If these valuable buildings are not preserved, they will deteriorate and finally vanish. There is a need to catch up with the pace of the new development. Everybody is happy about the value of historical buildings, but only a careful rehabilitation process can develop the area and transform it into a new age.

Despite most of buildings in the street example having signage identifiers, it was not felt that this is an added urban quality or can much help in terms of Imageability of the street. On the contrary, architectural identifiers like minarets were found to be much more effective in building the special image of the street. On the other side, non-rectangularity of buildings can somehow give them some more recognizable and memorable quality but there is something very important to be noticed here. It is the overall visual design quality and aesthetics of non-regular buildings that give them significance, memorability, and Imageability. There are irregular buildings that are ugly and visually not pleasing. They will not help the image of the street or the area.

Outdoor dining spaces are crucial factors for the vitality and vibrancy of modern urban streets. This is a modern western view related to the western city and culture. Cities of different environmental, economic, and cultural settings should not necessarily be following the same model. The harsh weather conditions in Manama during many months of the year do not encourage outdoor dining. This is in addition to the social and cultural values that also do not encourage such activity. Streets narrow and the commercial functions including food and drink providers are mixed with residential uses. Privacy and social calm constrained the development of outdoor dining facilities in old Manama. The street example considered has no outdoor dining, but it has its many indoor dining spaces that greatly add to its imageability due to their cultural and social values in addition to the special traditional types of food that cannot be found outside the old town.

The pedestrian count concept of western cities cannot be applied to old Manama. Crowded streets of the western city are considered a clear sign of walkability and strong imageability. On the contrary, low pedestrian streets in Manama do not mean they have less urban quality and less attractiveness. It is all about the rhythm of life and the revolution of cultural, social, and economic wheels. At prayers time the example street will get crowded with people going to Mosques and Matams and coming out of them. The same is the case with religious events and festivals. The example street with these activities will draw an effective image more than modern streets outside old Manama. At certain times these crowds make "noise" that is considered lovely and attractive, religious and spiritual. It is not the noise of traffic or machines. Other sounds come from commercial activities are also par of the culture of the area that add to



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its livability and vibrancy. Again, it is the subjective attitude towards urban space and its functions that can affect the formation of its urban image.

3. CONCLUSION

The model of Ewing et al (2005) is useful in giving some idea on Imageability but it is subjective, limited, and lacks accuracy in the measures. Ernawati (2019) provided subjective indicators without any idea of how to measure them except through users' questionnaires. AlBaqiri et al (2022) provided more practical details for the measuring of the same indicators of Imageability of Ewing et al (2005). They tried to take into consideration the actual real quality of the physical environment of the street. Still, it needs more development and detailing.

The complexity of the built environment needs careful consideration when it comes to the study and analysis of urban design qualities either the perceived ones like Imageability or the actual qualities of the physical environment and its functions. Therefore, urban streets need more care in considering their urban design qualities. It is crucial to consider the local cultural, social, economic, and political setting active in shaping the built environment and complementing its physical Imageability. This research also gives the opportunity to look at some aspects of the urban design qualities in Manama Old Town and it is hoped that future research will reveal more about these qualities.

Declaration of conflicting interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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SUSTAINABILITY OF CONSERVATION PROJECT OF THE RESIDENTIAL BUILDINGS AT THE HISTORICAL DISTRICT OF JEDDAH

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ABSTRACT

With the advent of modernization, the city's rapid development and significant changes in Jeddah's cityscape and urban fabric have occurred. In the continuation of this change, the situation of historical areas began to deteriorate. Conservation of its roots has become an important project due to change and deterioration. As it is defined as a world heritage site due to its significant heritage importance to the area. This article evaluates the ongoing conservation project in the historical Jeddah (Al Balad) region, which is on the world heritage list in the Kingdom of Saudi Arabia, in terms of the methodology adopted and the policies implemented. This article critically evaluates the architectural preservation initiatives made to preserve the buildings of this region, which are often regarded as some of the most astonishing architectural achievements in history. The study uses a qualitative research methodology that focuses on in-depth case studies from other published academic studies in Jeddah (Al Balad). At the same time, two case studies, Al Sharbatly House and Nasif House, were chosen as focused on residential buildings to analyze the criteria mentioned earlier, through the search for material restoration and analysis through qualitative research and literature reviews. As a result of this research offers a series of recommendations for improving the conservation project.

Keywords: Old Jeddah, Al Sharbatly & Nasif Houses, Heritage building, Al Balad region, Conservation.

1. INTRODUCTION

In the heart of Jeddah, a city steeped in rich history and cultural significance, lies a treasure trove of architectural heritage that embodies the essence of a bygone era. The historical district of Jeddah stands as a testament to the city's vibrant past, with its labyrinthine alleys, intricately carved facades, and timeless charm. Amidst the hustle and bustle of modern urbanization, the conservation of these residential buildings has emerged as a pivotal endeavor, intertwining the threads of cultural preservation and sustainable development. The imperative for sustainable conservation extends beyond the realm of architecture and resonates with the very essence of a city (El-belkasy, 2022). This article embarks on a journey through the complex interplay between preserving the historical essence of Jeddah's residential buildings and the imperative of sustainable practices in the face of contemporary challenges. Because due to the fast development of the city and the vast change in the cityscape and urban Fabric of Jeddah, the conservation of its roots became an essential project as the state of the historical areas start to



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deteriorate. It is defined as a world heritage site due to its significant heritage importance to the area.

This research is to analyse and study the conservation project that is held within Jeddah historic district, strategies and methodologies that have been applied, and as the project is still ongoing also look into some of the results of the completed parts of the conservation. In addition to investigating the preservation of the heritage while maintaining the local community's socio-physical, socio-cultural, and environmental aspects.

Hence, the study uses a qualitative research methodology that focuses on in-depth case studies from other published academic studies in Jeddah (Al Balad). Case studies for developing and conserving historic urban areas were analysed and compared to the applied strategies on the two case studies area, Al Sharbatly House and Nasif House, which were chosen as the study is focusing on residential buildings as its high significance and uniqueness in terms of history and culture in the area, through the search for material restoration and analysis through qualitative research and literature reviews. As a result of this research offers a series of recommendations for improving the conservation project.

Ultimately, this article invites readers to contemplate the delicate balance between the tangible and intangible aspects of heritage, and how the lessons learned from Jeddah's conservation project can illuminate a broader path towards sustainable development that respects the past and embraces the future.

All these aims will help to answer the following questions:

- What are the conservation methods implemented by the government?
- Why is it significant to conserve heritage buildings?
- What are the complications facing the conservation of the area?

In the meantime, the only restrictions that can happen during the research can be:

- Limited resources of the conservation resolution and techniques used within the project.
- High restrictions and limitations of access to the historical buildings.

2. MATERIALS and METHODS

This research includes both qualitative methods. As a qualitative method, photographs and articles about the cultural heritage of Al Balad residences belonging to different periods are collected by examining library and archive documents.

The first case study is Al Sharbatly House, which was built about 150 years ago and was originally owned by a merchant (Sharif Abdullella Muhanna of Abdali) who regularly traded between Jeddah and the Red Sea city. (Attia, 2021) because of its unique entrance and big meeting hall, the house served as an Egyptian embassy before it becomes a permanent residence to the famous merchant Abdullah al-Sharbatly. In the past 20 years, the house was turned into a museum for a few years and now after a preservation, the function has been changed into a public tourism attraction gathering point with a roof cafe.

The second residence belonging to Bayt Nassif also known as "The House with the Tree" since it was the only house in Balad that had one. The development of Nassif House started in 1872 and it was wrapped up by 1881 for Sheik Omar Effendi Nassif, at that point representative of



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Jeddah. This house had a place for the Nassif family until 1975. One of the beneficiaries, Sheik Muhammad, turned Bayt Nassif into a private library that inevitably collected 16,000 books. (Baik, 2015).

The two selected residencies from today are known as the tourism attraction points that were renovated by the Ministry of Culture and Heritage, these two tower houses were selected for their significant history and unique architecture in addition to their social impact and image on the area.

This research aims to search and identify the quality of conservation in the historical district, a qualitative analysis will be conducted through a literature review to improve the existing conservation process and provide recommendations to enhance the process. Review two case studies to show the conservation's results and effectiveness.

3. FINDINGS and DISCUSSION

Historic Jeddah

Historic Jeddah, often referred to as "Al-Balad," is a UNESCO World Heritage Site located on the western coast of Saudi Arabia. Its historical significance lies in its role as a pivotal trading port in the Red Sea, fostering connections between the Arabian Peninsula, Africa, and the Indian subcontinent. Historic Jeddah's historical significance is deeply rooted in its maritime trade connections that facilitated the exchange of goods, ideas, and cultures between Asia, Africa, and the Arabian Peninsula. This cross-cultural interaction is reflected in the city's architecture, customs, and traditions. Studies by Al-Mulhim (2014) underscore the city's role as a testament to the interplay of cultural diversity and historical continuity. The architectural diversity of Historic Jeddah reflects its long history as a global trading hub. The city boasts an array of architectural styles, including traditional coral stone buildings, Ottoman-style houses, and grand merchant residences. These architectural elements showcase the multicultural influences that have shaped the city's built environment over time. Research by Alsharekh (2010) emphasizes the importance of understanding these architectural styles as cultural artifacts, each telling a unique story of Jeddah's past. Also, research by Al-Hathloul (2004) emphasizes the importance of these architectural elements in conveying the city's identity and heritage while highlighting the need for conservation efforts to ensure their preservation (Heba, 2022). As the city modernized, Historic Jeddah faced urban development pressures that threatened its cultural and architectural heritage. The influx of modern infrastructure and commercialization posed challenges to the preservation of traditional structures. Habib M. Alshuwaikhat a professor and former head of City and Regional Planning (2007) highlights the tension between preserving historical authenticity and accommodating contemporary urban needs. Therefore, in this point, the article focuses on the second large city in the kingdom after the capital lies one of the most distinguished architectural styles in the area, Hejazi architecture. As it resembles culture, identity, and richness in heritage, it was listed as one of the world heritage sites by UNESCO in 2014 as characterized by a distinct urban heritage that was a symbol of Hejazi architecture (Waheeb, 2022). (Figure 1).



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Figure 1. Showing the historic district and urban fabric and areas with historic value Jeddah Municipality, Vol. II. p.94.

The historic district of Jeddah is located on the east coast of the Red Sea. Since the 7th century AD, the city was an important port for the Indian Ocean trade routes, through which goods were transported to Mecca. It was also the gateway for Muslim pilgrims coming to Mecca by sea. Because of these two functions, the city developed into a thriving multicultural centre

characterized by a distinctive architectural tradition, including the tower houses built in the late 19th century by the city's merchant elite, (Figure 2).

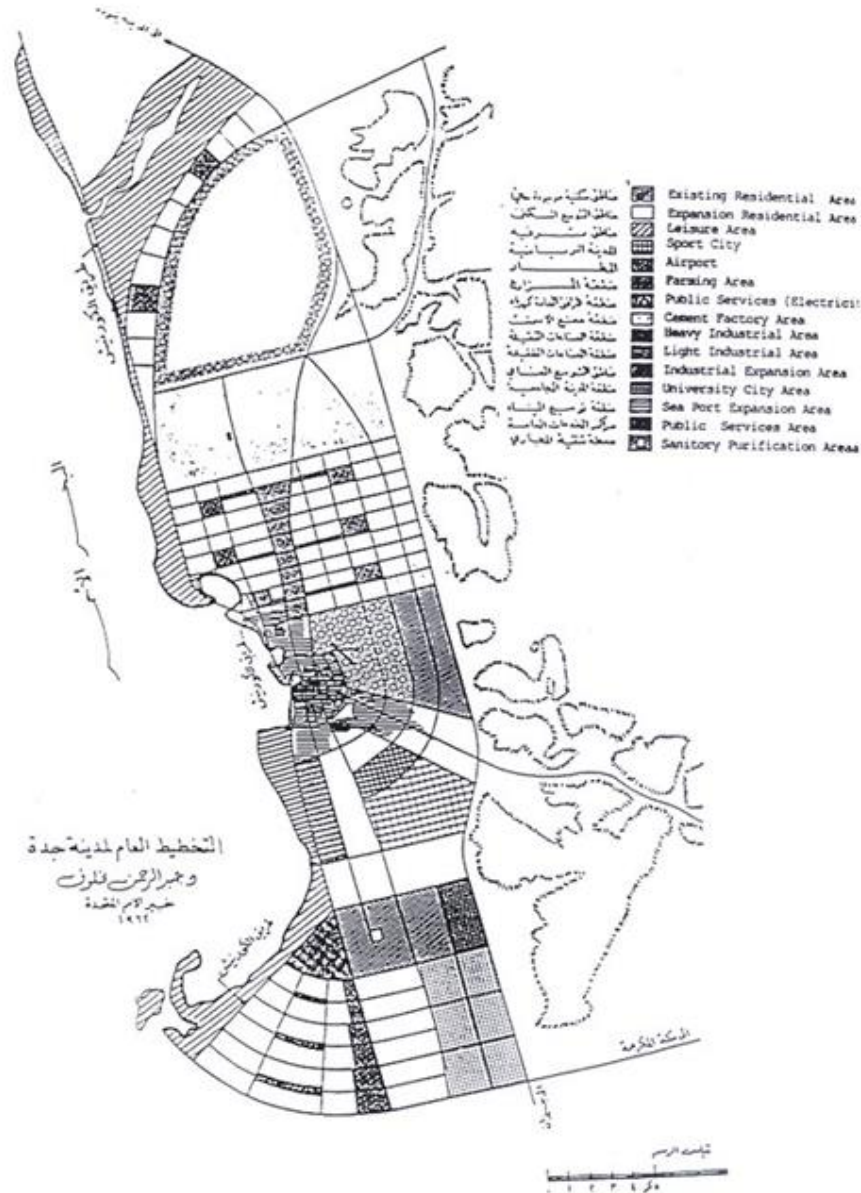


Figure 2. The First Master Plan of Jeddah 1962 by Dr. Abdul Rahman Makhlof. Source: Jeddah Municipality, Vol. II. p.94.

Jeddah City has a rich history, dating back more than 3000 years. The Old City of Jeddah features several ancient structures "around 350," which were erected more than 350 years ago with unique qualities that reflect the nation's culture. The city is located on the western edge of the Hijaz area, along the Red Sea shore. Jeddah is also the gateway to Islam's two holiest cities, Madinah and Makkah. Furthermore, this city is regarded as the Kingdom of Saudi Arabia's tourism and economic capital (Telmesani et al., 2009).



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Furthermore, (Al-Fakahani, 2005) states that "Muslim and Arab scholars recognized that the name Jeddah is derived from the Arabic phrase.

Urban Fabric of Historic District (Al Balad)

The urban fabric of a historic district such as Al Balad is a testament to the rich cultural heritage and architectural significance of the area. Al Balad, meaning "The Town" in Arabic, is a vibrant and bustling neighbourhood that showcases the traditional charm and historical importance of Saudi Arabia. The term "urban fabric" refers to the physical layout, structures, and design elements that shape the character and identity of a city or district. In the case of Al Balad, its urban fabric is intricately woven with narrow winding streets, traditional courtyard houses known as "Rawasheen/ Roshan," ornate wooden balconies called "Bayt Jeddah," and grand mosques, (Calogero, 2022). This historic district holds immense value as it provides a glimpse into Jeddah's past, showcasing its cultural diversity through its unique architecture and layout. Exploring the urban fabric of Al Balad reveals a tapestry of influences from various civilizations that have shaped its development over the centuries. From Ottoman-style buildings to Persian-inspired motifs, each structure tells a story about Jeddah's history as an important trading hub along ancient trade routes. Furthermore, Al Balad serves as an important centre for commerce, with vibrant souks (markets) offering traditional goods ranging from spices and textiles to handicrafts. However, during the last few decades, the deterioration of historical regions caused by rapid socio-economic developments all over the world has also affected these historical regions. Despite its economic benefits, this rapid development has adversely affected the historical regions of the cities. It has destroyed the old urban fabric and character of the city (Chohan, 2006).

The Saudi Tourism and Antiquities Commission has prepared a document for the inclusion of the historic centre of Jeddah on the city's list of World Heritage sites protected by UNESCO (World Heritage List); This record stems from the recognition of its undeniable value as a testament to its urban-architectural testimony to the culture of the Red Sea region, as has been repeatedly emphasized: "Historical Jeddah" (Abdu, 2002), (Figure 1). From the 15th to the early 20th centuries, in the region and along the maritime trade channels, the Sacred There was a convergence of cultural contacts, technological knowledge, resources, and construction techniques in the Indian Ocean leading to the City (Badawy, 2018). AL BALAD, (figure 3), is the only urban centre on the Red Sea coastline that preserves important examples of its culture. The market (bazaar) axes are still fully preserved in this part of the historic city, as the rest of the road network is not affected by the city's transformations: the only discontinuity is evident in the gaps caused by the collapse of 'historical' structures, (Al-ban, 2016), (Figure 4).



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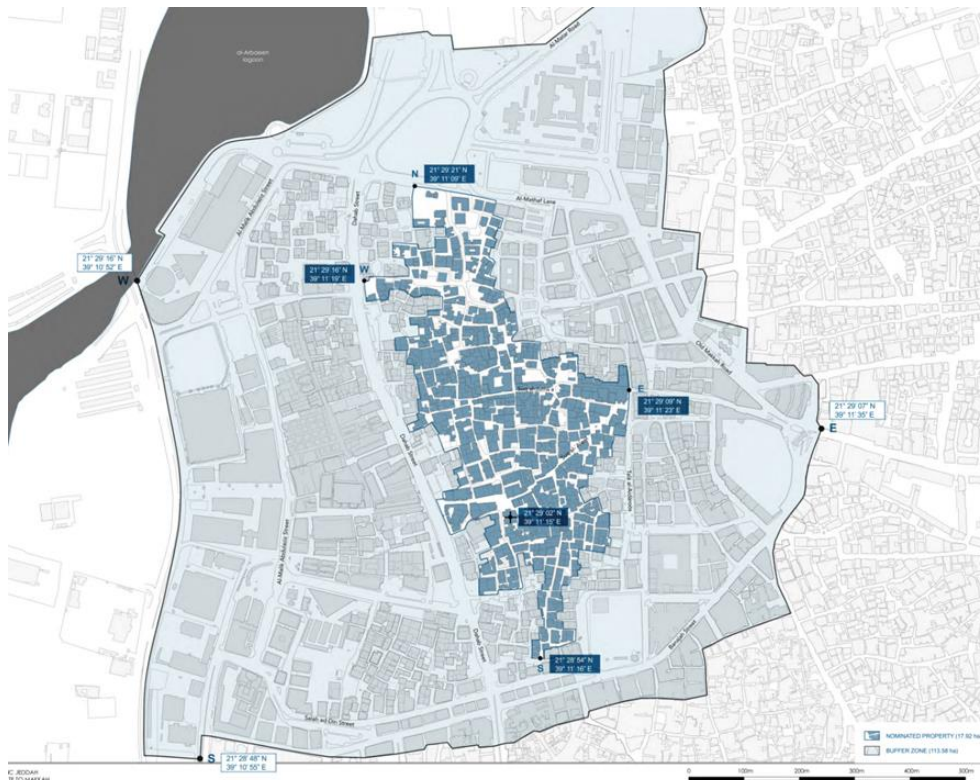


Figure 3. Showing the historic district and plan of (Albalad), (UNESCO Heritage site)



Figure 4. Examples of the Hijazi architectural building in old Jeddah (Albalad), (UNESCO Heritage site)



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Typology of Traditional Tower Houses in Jeddah

Traditional tower houses in Jeddah, Saudi Arabia, are known for their unique architectural features and cultural significance. These tower houses, known as "Roshan" or "Rawshan," are characteristic of the city's historic districts like Al-Balad. Here is a typology of traditional tower houses in Jeddah:

1. **Roshan Architecture:** Roshan houses are distinctive for their elaborately carved wooden screens, known as "Roshan." The Roshan screens adorn the windows and balconies, providing privacy while allowing ventilation and light to filter through. Roshans are intricately designed with geometric patterns, floral motifs, and calligraphic elements.
2. **Vertical Design:** Jeddah's tower houses are known for their verticality, with several stories that accommodate extended families and different functions. Each floor serves a specific purpose, often including living quarters, storage, and communal spaces.
3. **Courtyard and Central Atrium:** Many tower houses feature an internal courtyard or central atrium, providing an open space for family gatherings, ventilation, and natural light. The courtyard often features a small garden, fountain, or seating area.
4. **Elevated Living Quarters:** Living quarters are often located on the upper floors of the tower house to provide better ventilation and views. The upper floors are accessed via staircases, which can be narrow and winding due to space constraints.
5. **Mashrabiya and Ventilation:** Mashrabiya screens are common in Jeddah's tower houses, similar to the roshans but made of wood or latticed panels. These screens allow airflow while maintaining privacy for residents. Small windcatchers or wind towers on the roof facilitate natural ventilation.
6. **Decorative Elements:** Tower houses are adorned with intricate stucco work, geometric patterns, and calligraphy on walls and ceilings. Ornamental detailing reflects Islamic art and local design traditions.
7. **Community and Social Interaction:** Tower houses were not only individual residences but also contributed to the social fabric of the community. Neighboring tower houses formed interconnected networks that fostered social interactions.

For example, during the economic boom that followed the opening of the Suez Canal in 1869, the point connecting the East and the West of the Jeddah port became an important trade point, as a result of which the houses in Jeddah reached up to 7 floors. These houses belonged to wealthy merchants and merchants, and they became highly decorative and unique in terms of architectural aesthetics. They also recognized them as mixed-use homes as the ground floor is often used for commercial purposes such as offices or sometimes warehouses. Nassif House is one of these examples. (Figure 5).

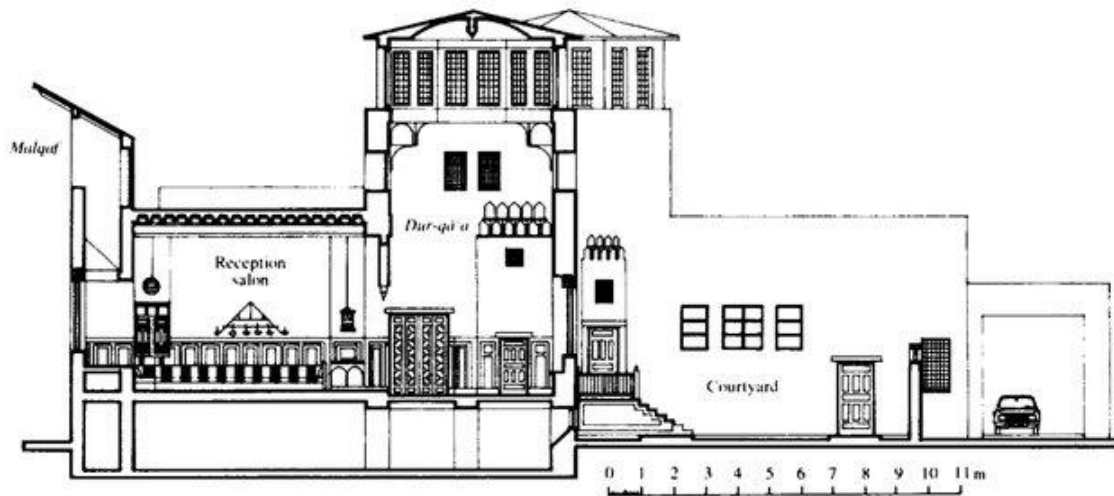


Figure 5. An Example of the tower house, Nassif House, in Jeddah, Saudi Arabia, (New Zealand Digital Library)

The interior design of the houses is based mainly on maintaining privacy as shown in (Figure 6), especially for transporting goods implemented throughout the Arabian Peninsula the features of the house are:

- The window leveled above road level.
- Roof terraces are divided with high balustrades.
- Men/guest reception rooms are separated from women's interaction areas within the house.



Figure 6. Examples of the Hijazi architectural building in old Jeddah, (by Author)

Regulations And Policies of Conservation, Preservation, And Restoration in Traditional Tower Houses in Jeddah

The policies are applied in two main parts: Robert Matthew policies and Jeddah municipality policies. Robert Matthew's policies depend on conserving the city and buildings with distinctive urban character are preserved, linking heritage areas with new urban extensions



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divided into two different levels: urban fabric and classification of heritage buildings (Gena, 2022).

The classification was based on the historical importance and condition of the building, there were divided into 3 different groups A, B, and C.

- A- Buildings with national relevance.
- B- Buildings with regional importance.
- C- Building with local significance.

On the other hand, there are Jeddah municipality policies with the cooperation of the Saudi Commission of Tourism and national heritage developed a set of policies summarized as follows:

- Preparation of a list of iconic buildings that need preservation.
- Encourage building owners to restore their properties under the commission's supervision to ensure the best result of the restoration operation
- Preserve the original status of the area by providing suitable landscape elements to the historical and heritage site.
- Provide suitable parking areas and spread awareness among local communities through the application uses of heritage festivals and activities within the area, (Alzahrani, 2016).

1. Preservation and Restoration

The first part of historic city recovery is the execution of temporary works for the safety of severely damaged structures (demolition, shoring, installation of metal rod support, bands, hoops, etc.).

Interventions are required to:

- Prevent further damage.
- Protect bodily injury.
- Restore regular economic and social activities.

The most difficult of these tasks are those involving the selection of the best sort of intervention, good performance, and cost optimization.

The following design method needs to be followed:

- 1) Identification of the building type;
- 2) Evaluation of the damages;
- 3) Identification of the damaging mechanism
- 4) Assessment of the need for temporary operations;
- 5) Determination of the kind of intervention (structural sections or non-structural destruction, installation of temporary works to sustain vertical loads and/or retention compared to horizontal activities, and so on) and the appropriate technique for the specific condition of the building;



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6) Provisional work in which each case is to be studied and examined separately based on the following factors:

- Building geometry and type.
- Active collapse mechanism
- Building size and damage location and the accessibility to the interior safely.
- Building materials
- The life span of the building and how fast is needed for operation.
- The surrounding area's condition and use.

2. Material Analysis

The vernacular materials used in the restoration of the building must be the same as the original material or the nearest in characteristics, the main materials that needed the most attention were the main visible which are defined as original building materials such as stone, bricks, or blocks, wood and plaster decoration in which is referred to as traditional building materials.

2.1. Stone and Mortar

Hadjar baharj is a grey hard stone block made from Madre pore stones including concretions reefs of the Red Sea and other tropical seas. These were discovered in the shallow seas of the Red Sea shore near the city of Jeddah.

Even blocks of coral (Coral blocks) were employed on occasion in construction. These have comparable characteristics as Mangabi stone (for insulation and resistance) as Shown in (figure 7), but are lighter; more expensive to remove, and were not utilized as standard material, even though coral blocks are frequently found combined with limestone.

Hadjar manqabi = Stone coral limestone formed by coral reef consolidation: this type of stone is extracted in the Manqabah lagoon northwest of Jeddah.

The stone coral was taken from the local neighborhood of the old town and was simply known as "mangabi." To the north of the old city, traces of ancient quarries may still be seen. It's a reasonably straightforward stone to cut and work with, especially if just for a brief period because it hardens when exposed to air. It is permeable, has strong insulating characteristics, and is relatively light (1.5 t / m³). To survive the corrosive effects of the saline air on the Red Sea shore, stone walls of mangabi must be plastered, as was traditional in old Jeddah.



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Figure7. Shows several examples of Mangabi stones

Mortar restoration is a word used to designate a collection of commercially produced, proprietary materials created exclusively for the restoration of masonry units, most often natural stone and/or brick. These materials are part of the larger and less well-defined category of 'plastic' repairs (repairs using any workable substance that will stick to a substrate and solidify after application), although they should not be confused with conventionally produced tailored lime 'mortar' repairs. The term 'restoration mortar' does not denote a specific material composition. Many 'off-the-shelf' goods with drastically varying compositions are available on the market. Restoration mortars should ideally meet a variety of technical and visual compatibility requirements, such as high vapor permeance and water.

2.2. Wood

The use of wood is more interesting, especially in the implementation of bearing walls of buildings: the walls are reinforced by elements-wood (figure 8) placed chains typically every six courses of stones (each application is approximately 20 cm.) both outside and inside the wall and connected transversely to it _ not always this link appears to exist. These chains may be formed out of joists of square sections or planks, usually made of teak wood from India, and have the role of load balancing while also offering higher resistance to the buildings and stability by counteracting drooping settling. Furthermore, the building's wall construction was linked by a type of "belt-edged wooden" horizontal that was necessary to resist any shock waves that define the location.



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Figure 8: Shows wood treatment and wooden support, (by Author)

The wood was covered with mortar mixed with stone shards to provide a type of bed for later block action. An issue occurred due to termite aggression on wood, which the "masters" attempted to remedy by treating the wood with a type of adhesive / bitumen used in boat construction. However, there was still the issue of extreme humidity in Jeddah. It was attempted to solve both concerns, termites, and dampness of the wood, by employing exceptionally resistant (also in terms of the pillars and beams composing the floor slabs) materials such as palm tree trunks from a location near Mecca or certain teak obtained from overseas.



Figure 9: Conservation and restoration process of floors, doors, and windows, (by Author)



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4. CONCLUSION and RECOMMENDATIONS

At first glance, the conservation project accomplishes most of its goals in terms of saving the building in the best way possible as it is under deep analysis of the heritage and culture of the area. The advantages of conservation not just saving the city's identity but also preserving this history for next generations to come, the social, economic, and environmental benefits are significant to the area, it has a great impact on people living within the area and its surrounding, it encourages investments and boosts tourism as it will change the previous image or perception of the town. The conservation and preservation of the residential buildings in the historical district of Jeddah represent a critical endeavor that transcends the realms of architecture, culture, and heritage. This project not only safeguards the physical structures but also ensures the continuity of a living historical narrative that is intricately woven into the fabric of the city. The significance of this initiative extends far beyond the preservation of mere buildings; it encapsulates the essence of Jeddah's identity and serves as a bridge connecting the past with the present and future. The undertaking of conserving and preserving these historical residential buildings is not without its challenges. Balancing the demands of modern urbanization, infrastructure development, and the imperative to retain architectural authenticity requires thoughtful planning and collaboration among various stakeholders. Community engagement plays a pivotal role, ensuring that the voices of those who reside within and around these historic structures are heard and integrated into the preservation strategies. On the other hand, there were some main issues that occurred analyzing those methods and policies, one is regarding the alternation of some materials in restoration such as the use of cement mortar which is less breathable compared to the original lime mortar which is considered more sustainable, the implementation of new materials such as reinforced concrete and steel turned out to be alien to the original materials in which integrating those modern elements are non-reversible and can not be undone. The second main issue was social, as not all building owners agreed on conservation plans, some areas were forced into it which affect them, and some others were preserving and conserving on their terms which might cause damage to the building rather than save it, so the implementation of the regulations has to go moderate in parallel with the owners where this project can benefit all parties. The reuse and changing of the function of the original structure might affect the general urban fabric of the place as most of these iconic houses were changed into hotels and general open-to-public areas also the excessive usage of the structure might affect the building durability, as controlling human activities and behavior is very difficult if it's open for public. In the end, the conservation project at the historic district is a significant right step into preserving the city and local heritage and it has almost no negative side in elevating the area into a better place. As these architectural gems are meticulously revitalized, they become more than just buildings; they become vessels that carry the stories of the people who lived, loved, and shaped the city. The project's success lies not only in the physical transformation but in the intangible heritage that is safeguarded and passed down to future generations. The conservation and preservation of the residential buildings in the historical district of Jeddah stand as a testament to the enduring power of heritage to inspire and connect across time and space.

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SMART, GREEN, ECOLOGICAL & SUSTAINABLE CITIES: THE SCIENTIFIC MEETING POINT

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ABSTRACT

Cities account for 60-80 percent of energy consumption and 75 percent of carbon emissions despite occupying only 3% of the Earth's territory. Cities are particularly sensitive to the effects of climate change and natural catastrophes due to the high concentration of people, infrastructure, housing, and economic activity. Building urban resilience is critical for avoiding human, social, and economic losses while enhancing the sustainability of urbanization processes is required for environmental protection, catastrophe risk reduction, and climate change mitigation. A sustainable city uses urban planning and administration to address social, environmental, and economic impacts. The quality of life in cities is strongly linked to how cities use and manage their natural resources. Cities can leave a net zero footprint for a more sustainable world by implementing planned infrastructure, public green areas, efficient garbage collection, and other initiatives. The notion of a sustainable city blends eco-friendly behaviors, green areas, and supporting technologies into the urban environment to minimize air pollution and CO₂ emissions, improve air quality, and safeguard natural resources. These activities result in a healthier environment for city residents as well as a lower carbon footprint for the city as a whole. Sustainable cities are becoming increasingly important in the fight to counteract global climate change. With clean technology, parks and paths, and urban sustainability principles, smart cities are building sustainable places. The study explains the relationship, similarities, and shared goals of the categories "Smart, Green, Ecological, and Sustainable Cities" as stated. It also considers how these phrases educate societal members about the quality of life, particularly in cities, as well as how to manage the natural resources available in cities. As a result, it examines how green living habits will be promoted in households and offices. The report summarizes the findings by urging that individuals, governments, industries, and all other stakeholders be warned of the future dangers of our activities if they are not quickly checked and sensitized.

Keywords: Sustainable Cities, Smart Cities, Climate Change, Green Cities, Ecological Cities.

1. INTRODUCTION

A sustainable city is sometimes defined as one that has the least negative influence on the environment, is inhabited and governed by people who are committed to reducing the amount of energy, water, and food needed, as well as the amount of waste heat produced, and the amount of pollution produced. A sustainable city is frequently referred to as an "ecocity" or an "eco-city" in this context. A sustainable city should produce the least amount of environmental pollution, utilize the land as efficiently as possible, compost used materials, recycle garbage, or turn waste into energy. All of them ought to significantly lessen the city's overall greenhouse gas emissions that contribute to climate change. Humans only have one known home, which is Earth. It is where people find the things they need to live and survive. The biosphere or ecosphere of Earth is composed of a variety of habitats.



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Humans obtain their requirements from the many ecosystems. In other words, ecosystems supply the natural resources needed by people and other types of life on the planet. Our ecosystems must therefore be preserved and maintained in order to benefit both the current and future generations. Ecosystems are, however, frequently harmed and destroyed as a result of the thoughtless, greedy, and uncontrolled over-exploitation brought on by fast industrialization. Ecosystem destruction affects both the environment and the animals that live there, in addition to the resources such ecosystems supply. Earth's resources are limited, but human demands are increasing right now. For instance, if a 1 km² piece of land can meet all of the demands of 1 person, then putting 2 people on the same piece of ground would result in a lack of resources. According to another viewpoint, resources would not be sufficient if a single person doubled his demands. Chan et al., (2016) Urbanization, rising environmental consciousness and concern, and technology advancement have all contributed to the urgent need and opportunity to reconsider how we design and run our cities. These related concerns have begun to converge in recent decades under the new umbrella of "smart sustainable cities" (Höjer & Wang, 2014).

The literature on "smart cities" has developed over more than 30 years, from the earliest writings on the topic at the end of the 1980s to the current surge of publications on the topic. The word and concept's early development can be dated to the years 1985 to 1995, but after 2000, it started to be systematically utilized in urban development, planning, IT, and engineering literature (Komninos 2018). Future-focused academic-scientific research shows that the main causes of our world's shift from today will be global issues like climate change, resource consumption, natural disasters, overpopulation, and uncontrolled urbanization. It is underlined that "urbanization"—defined as the increase in carbon and other hazardous emissions—is the main cause of the temperature rise, which is classified as global warming. In this regard, it is feasible to say that the effects of the process of urbanization's growth in the number of cities and urban population can be seen in the natural environment's increased vulnerability to climate change and natural catastrophes. In light of this, it may be said that the process of economic, geographical, political, and cultural upheaval has placed the cities of the future in an ecological crisis. As a result, discussions about maintaining ecological balance are centred on sustainable urbanization and the search for sustainable cities. The impact on environmental resources is increased by urban sprawl and rapid population growth, as is the demand for physical resources in cities. Through information and communication technology, the idea of a smart sustainable city presents a framework to guarantee inhabitants a better life and safeguard the environment to maintain sustainability (Liu et al., 2022). There is a critical need to create creative energy systems in smart cities due to the world's population growth, the exponential rise in global energy demand, and the requirement for more resilient infrastructure than before (Abu-Rayash et al., 2021).

2. RELATED LITERATURE

Some of the related pieces of literature are discussed below: In his research on how sustainable urban planning offers cities a way to prevent climate change, Hameed (2020). According to him, integrated urban zones are constructed to bring together people, activities, buildings, and public amenities, with easy access to one another via foot or bicycle and a nearly perfect transportation system to the rest of the world. In other terms, sustainable development, economic growth, or an eco-city (sometimes referred to as an "ecocity") is a town designed with socioeconomic, cultural, and environmental (often referred to as triple) aspects. His study included a variety of fundamental elements of sustainable urban development and green cities



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from many angles, allowing for extensive analysis. He continued by emphasizing how using environmentally friendly systems and materials, as well as improving indoor air quality and using high-efficiency or rational street lights, reduced the impact of a building on its surrounding environment. Additionally, those who work or live in these buildings directly benefited from these changes.

Satterthwaite (2010) noted that the borders of any urban center have an impact on its population, such as whether they are based on the built-up region or encompass peri-urban areas with little to no urban development. If peripheral inhabitants are included in official statistics, the size of a city can be greatly inflated; many cities have limits established to cover the city and wide territories around it, which may include small towns and major rural populations. The majority of large cities have many limits, such as those for the center city, the entire metropolitan area, or a larger planning zone that frequently includes numerous rural villages. Typically, residents of urban areas are those whose primary source of income is not derived from forestry or agriculture.

In (2014) Höjer & Wangel looked at the idea of smart sustainable cities. They started with five significant recent discoveries and demonstrated how they may be used as a foundation for the idea of smart sustainable cities. They contend in the same way that a stricter definition is required now for the concept to have any real meaning at all. They offered such a definition and mentioned some of the more significant difficulties with the idea.

Based on a thorough analysis of the literature in the area, Tura et al. (2022) established the connection between sustainability-oriented innovations (SOI) and the growth of smart cities. Following the evaluation process, 159 articles were carefully chosen for the in-depth investigation of the related ideas of smart cities and technologies geared toward sustainability. The findings revealed a rising tendency in this field's research articles, particularly over the previous five years. The results highlighted the value of a systemic, multi-dimensional view of innovations for the efficient, sustainable growth of cities. They determined that four key perspectives—technological, organizational, and social innovation with citizen participation, and system-level changes with innovation ecosystems—were used by scholars to discuss the SOI components in the context of smart cities. They discovered many narrowed themes beneath each primary perspective, second. Different aspects of smart cities were impacted by the numerous inventions. Recent studies focused on governance issues and the perspectives of technological innovation, but an increasing number of research outputs also reported on the advancements of other elements and perspectives, such as novel human-centric strategies like citizen engagement.

According to Anthopoulos et al. (2022), the Smart City can function as a "hub" that gathers, analyzes, and transmits data, brings people together to co-design and evolve, and manages service, material, and people flows in all city kinds. In order to standardize and regulate all city flows, the paper outlined the function, the applications, and the architecture of this "Smart City-as-a-Hub" operation called "SCHub."

Using the International Telecommunication Union (ITU) maturity model, Liu et al. (2022) built a sustainable smart city development indicator system and evaluated the maturity level of 35 Chinese towns. To identify development trends across 53 indicators and three dimensions, spectral clustering was used. Four development patterns were revealed by the results. Cities with comprehensive development brought together finishing developing aspects. By



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government directives and with the assistance of information and communications technology, environmentally friendly cities improve the environment. Welfare cities demonstrated strong social welfare through the government's laser-like concentration, but they lacked financial assistance. Undeveloped cities were marked by innovation, trade, capital investment, mental poverty, and substandard living circumstances. According to development differences, practical recommendations are made for each kind to create a smarter, more sustainable city. Abu-Rayash et al. (2021) developed a brand-new approach to rate cities' level of smartness. An evaluation of eight key areas, including the economics, environment, society, governance, energy, infrastructure, transportation, and pandemic resiliency, was used to define a smart city. By examining several crucial factors that reflect the state of each domain in each particular city, each domain was appraised. All indications could be measured and evaluated, which increased the approach's objectivity and accuracy. The model was used in 20 places across the globe. The smart economy index for all cities doubles when the smart energy index is increased by 25%. Additionally, a moderate improvement in the smart economy index is produced by a 50% increase in GDP per capita. With a p value of 0.004, the association between smart governance and smart economy was positive and linear. The highest Smart City Index was 0.8 in Montreal, while the lowest was 0.3 in Abuja. To increase the Smart City Index score and create more resilient and smart cities, the socioeconomic and energy domains must be strengthened. In order to divide society into three strata—the micro (individual), meso (organizational), and macro (system), Costales (2022) used a systems approach. To investigate how Smart Cities were envisioned, the researcher conducted a systematic examination of the literature on smart cities. The research discovered a dualistic phenomenon—sources of innovation (SOI) and loci of change (LOC)—occurring at all places in the stratified city system through an analysis of 41 papers. In this case, LOC referred to the structures that allowed the learning curve to spread throughout the system, whereas SOI related to the perceptions of deficiencies that started the learning curve of innovation. The analysis showed a lack of focus on the human and system strata and an overemphasis on the organizational stratum.

The researcher created the Social Innovation Cycle to fill the gap. The interdependencies of SOI and LOC were incorporated into the multi-level social innovation framework to connect all strata, ameliorate power imbalances, and lessen marginalization.

By doing this, the researcher identified potential policy implementation areas for the comprehensive development of the Smart City. It was suggested that Smart City policies should concentrate on the point where SOI and LOC meet in order to promote human-centricity.

The impact of SDG institutionalization on the idea of smart, sustainable cities was evaluated by Blasi (2022). To determine the degree of congruence and prospective development areas, the researcher researched literature on smart cities and SDGs.

The findings showed that there are brokerage keywords, which are absent from the portfolio of overlapping keywords yet rank highly in both fields of literature. This was true of governance, energy, water management, and teamwork. While sharing certain similarities but being studied in distinct ways were ideas like sustainability, waste management, civic involvement, and innovation.

Based on empirical research presented in the form of case studies, Bibri (2021) created an integrated model for strategic sustainable urban development. In terms of its strategies and solutions, the model merged and integrated the three most prominent global urbanism



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paradigms: eco-cities, data-driven smart cities, and ecologically data-driven smart sustainable cities.

The study's primary contribution was to offer a novel strategy for creating future models for sustainable urban development as well as practical knowledge about how to create transformative strategic planning processes for sustainability based on integrated methods.

The suggested methodology helped cities that were regenerating as eco-cities, earning the title of eco-cities, or ostensibly planned to be or become smart eco-cities in the big data era go closer to fulfilling the long-term sustainability goals.

Relationship Between the Cities

There are so many words that could imply something or mean something related to something else. Smart city, green city, ecological city, and sustainable city are a few of these terms. In the long run, all of these cities strive to accomplish comparable goals.

Therefore, smart cities are green cities, ecological cities, and sustainable cities since they strive to improve human well-being.

Smart cities utilize electronic techniques and sensors to gather data and enhance the effectiveness and sustainability of their services and operations.



Fig.1: Smart city example

Green cities are those that have been planned with the influence on the social, economic, and environmental landscape as well as providing a stable environment for present and future people in mind.



Fig.2: Green city example



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Ecological city - An ecologically sound city, often known as an eco-city, improves the welfare of its residents and society by utilizing integrated urban planning and management techniques that harness the advantages of ecological systems and safeguard and preserve these resources for future generations.



Fig.3: Ecological City example

A sustainable city is one that uses urban planning and city management to solve issues of social, environmental, and economic effects.



Fig.4: Sustainable City example

Four Pillars of Smart, Green, Ecological and Sustainable Cities





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Education, health, food and nutrition, green homes and buildings, water and sanitation, green public transit, accessibility to green energy, recreation places, and community support are all aspects of social development.

Included in economic development are: green economic growth, the creation of good jobs, the generation and distribution of renewable energy, and technological and innovative advancements

Forest and soil management, waste and recycling management, energy efficiency, water management, air quality preservation, and adaptation to and mitigation of climate change are all part of environmental development.

Planning, decentralization, reducing inequities, bolstering civic and political rights, and supporting connections across local, national, regional, and global levels are all aspects of urban governance.

Table 1: Cities with indicators and their objectives

Cities	Indicators	Objectives
1. Smart Cities, 2. Green Cities, 3. Ecological Cities, and 4. Sustainable Cities.	Jobs, Income, Housing, Access to services, Education, Political Participation, Health, Environmental Quality, Personal Safety, Community, and Life Satisfaction Economic, Gender Issues, Migrant and ethnic, and Inter-generational Issues Energy, Climate, Biodiversity, and Material footprint Health and social, and Institutions	<ol style="list-style-type: none"> Well-being - the state of being comfortable, healthy, or happy Inclusion - the practice or policy of providing equal access to opportunities and resources for people who might otherwise be excluded or marginalized, such as those who have physical or intellectual disabilities and members of other minority groups Sustainability - meeting the needs of the present without compromising the ability of future generations to meet their needs Resilience - the ability to withstand adversity and bounce back from difficult life events



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Table 1 shows the main goals of all the cities (smart, green, ecological, and sustainable). With the indicators of Jobs, Income, Housing, Access to Services, Education, Political Participation, Health, Environmental Quality, Personal Safety, Community, and Life Satisfaction, it was demonstrated that all cities are essential for human well-being, inclusion, sustainability, and resilience. Economic, gender-related, migrant and ethnic, intergenerational, and environmental issues. Other issues include energy, climate change, biodiversity, and the material imprint.

3. THE MEETING POINT FOR SCIENTISTS

Smart, Green, Ecological/Eco, and Sustainable cities all strive to offer a stable home for current and future generations without damaging the environment's ecosystems and natural resources. They might also include environmentally friendly options in the design of city streets, such as bike and walk lanes. They also aim to preserve the natural world and promote the health and wellness of the city's inhabitants. This is the meeting point of scientists all over the world.

4. CONCLUSION

Being a sustainable city is not an easy task. It takes a lot of political will, money, dedication, and perseverance over an extended period of time. In order to provide its residents with a good quality of life, a sustainable city undoubtedly blends sustainable growth with sustainable solutions. All of the city's stakeholders must be able to understand, believe in, and commit to the city's ambitious green strategy or goal. A sustainable city should set a high goal to achieve CO₂ neutrality by 2025, or at the absolute least, drastically reduce its CO₂ and other greenhouse gas emissions. If a city ignores climate change and adaptation, it cannot make the claim to be sustainable.

As a result, the city needs a climate adaptation plan and a program to be climate resilient. The city's transportation system can be made more environmentally friendly by using public transportation, bicycle and pedestrian strategies, clean energy cars, green structures, and the banning of toxic and damaging materials. Additionally, residents' consumerist lifestyles can be replaced with more simple ones.

The city must have implemented plans and initiatives to address each of the 17 UN SDGs. In the same vein, the city should prioritize developing a green and sustainable society. Although most towns currently only use a small portion of renewable energy, the ultimate objective of a sustainable city should be to have 100% renewable energy by 2050. The principles of participation, debate, collaboration, societal responsibility, and income distribution—all the pillars on which the contemporary sustainability movement is based—should be embraced by sustainable cities as a matter of policy.

It is necessary to implement laws on sustainable development in cities that are effectively enforced. While harshly punishing individuals who continue to use non-renewable energy sources, cities should offer sufficient incentives for low-carbon technologies and renewable energy production.

Finally, a sustainable city should include opportunities for social engagement, business transactions, trade, and leisure. For civil society to function effectively, there must be sufficient and appropriate public areas. For the sustainable city to encourage participation, recreation, pleasure, accessibility, and convenience for individuals who live, work, and relax, designated roadways, parks, green spaces, water spots, public squares, and cultural locations must be planned. Interactions between cities and their inhabitants are essential for a sustainable city.



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The city should no longer be entirely managed and ruled by elected officials, but rather take on a shared responsibility with all stakeholders working toward a people-oriented city in their individual capacities. Ownership is the only way for city dwellers to truly commit to making their city a better place to work, live, and play.

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SMART CITIES OF THE FUTURE

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ABSTRACT

The article discusses the concept of a smart or intelligent city and whether there are similar cities and technologies in Bulgaria. It also presents how smart cities respond to climate change and changes in the environment we live in, what challenges face smart cities, what their main purpose is and what are the effects of smart cities, what and how they will manage to improve. Sofia is ranked 107th out of a total of 118 ranked smart cities according to the "Smart City Index 2022"¹ of the Management Development Institute at the Singapore University of Technology and Design. In order to turn Sofia into a smart, sustainable and easily adaptable to climate change city, it is necessary to work both structurally and technologically in the areas of health care and security, recycling, mobility, utilization of green areas, as well as in the management sector. It is necessary to build and strengthen innovative ecosystems and new technologies, and promote interaction between education, science and innovation.

Keywords: Smart City, Climate Change, Innovative Technologies.

1. INTRODUCTION

In recent years, the concept of a smart or intelligent city has entered more and more into our daily life and work, in the media and scientific circles. Smart technologies that have a positive impact on lifestyle are increasingly being adopted in major cities around the world. Numerous studies on smart cities and technology have also appeared.

A smart city can be both the whole city and a certain territory of it, where electronic and technological infrastructure, such as information and communication technologies, are used to collect data and make real-time analysis, providing certain important services to solve urban problems. With the growing need for sustainable cities in the global context of climate change, the concept of a smart city places the environment and surrounding climate, including the interaction between technology and nature, promoting the integration of climate strategies and citizen participation in order to adapt from climate impacts.

The main goal of a smart city is to improve well-being and adapt to climate change by providing services that support each and every resident. Smart cities improve the daily activities of the city, such as public transport and mobility, electricity and water supply, sewage systems, etc. Using this data, local governments can extract useful information and provide effective solutions to correct prevailing urban problems.

¹ Institute for Management Development, and Singapore University for Technology and Design (SUTD). 2022. Smart City Index [online]. Available from: <https://imd.cld.bz/Smart-City-Index-2022> [accessed 01 January 2023].



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According to the Smart City Guidebook² of the Ministry of Economy, Trade and Industry of Japan, its effects vary widely, and examples of expected results are described below:

- Society: realization of a safe, high-quality life for the residents

Effect of realizing social inclusion that allows all residents to live equally, by providing more efficient city services in all areas, including administrative procedures, purchases, transport, medical care, health and tourism, as well as providing services that meet individual characteristics and preferences.

- Economy: implementation of sustainable and creative urban management and economy

This direction would have a positive effect in several directions:

Creating an environment in which different services for residents and companies are implemented one after the other, using different data and new technologies that revitalize the regional economy,

Driving the regional economy through the consumption and purchase of services by residents and visitors who come and go in a safe, convenient and comfortable city, as well as creating diverse innovations through interactions, increasing the efficiency of systems in companies and governments and improving productivity.

- Environment: implementation of ecologically clean cities and regions

Effect of optimizing the use of energy/resources in accordance with the actual travel of people and goods in all situations, such as business operations, daily life and travel behavior, realizing a decarbonized society.

One of the main expectations is to improve overall services by collecting and using different data from a diverse range of sectors. Another expectation is to solve the challenges with new frameworks through the participation of scientific institutions, industry and government, as well as involving residents from many cities.

A smart city can change our way of life by ensuring fairness and inclusion of residents to enjoy smart services equally, protecting privacy in the use of personal data, including personal information, from the perspective of providing high-quality services that comply with the needs of individual citizens and consumers. Ensuring interoperability, openness and transparency by implementing the data platform interoperable with other regions and systems for nationally effective smart city promotion. Ensuring the safety of the services provided, continuity of the system in emergencies, including during disasters, etc. Ensuring operational and financial sustainability that is carried out by a core organization. An example would be a local government on the one hand. On the other, it is public, private and academic entities that cooperate appropriately, play their roles to be functional and flexible and bear the costs of maintaining the system and providing services.

There are numerous examples and applications of smart technologies. These can be in the form of software decision-making, smart technologies connected to other devices via the Internet or

² Ministry of Internal Affairs and Communications Ministry of Economy, Trade and Industry of Japan, Ministry of Land, Infrastructure, Transport and Tourism of Japan, Smart City Public-Private Partnership Platform Secretariat. 2022. Smart City Guidebook [online]. Available from: https://www8.cao.go.jp/cstp/society5_0/smartcity/01_scguide_eng_1.pdf [accessed 01 January 2023]



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applications that allow the user to control their devices easily and conveniently and can be connected to an external service provider. It is important to mention here that smart technologies help to reduce energy and thus have a beneficial and long-term impact on climate change adaptation.

Smart home technology has become very common in recent years. They cover a wide range of applications such as security systems, lighting systems, smart cameras, remote controllers, sockets and plugs. These technologies can provide remote access to the homeowner as well as allow the user to perform various home automation tasks such as turning off lights, applying door locks, monitoring around the home, and more.

Devices such as smart thermostats, for example, can show how much energy is being used when changing the temperature in our homes, resulting in much less energy being wasted.

On the other hand, smart lighting can reduce electricity consumption by using dimming lights on streets without pedestrians or traffic. Such lighting systems are often also equipped with central management software that monitors usage and drives maintenance efficiency.

An example of smart management could be a waste initiative. A city that implements innovative waste management solutions can reduce costs by emptying waste containers by using sensors installed in the containers. Sensors can monitor the individual waste level and thus the containers are only emptied when they are full, rather than on a standardized schedule. Thus, the traffic is also reduced, since there are fewer specialized vehicles for waste on the streets, which in turn contributes to the reduction of greenhouse gas emissions, improving the air and climatic conditions in the cities.

In Bulgaria, in recent decades, we have witnessed an increase in the use of electricity, the transport network is becoming increasingly congested due to the excessive use of private cars, and we are observing inefficient use of public transport. The temperature in the city increases and air quality deteriorates, as a result of global and local climate changes and human activity, the carbon footprint on the environment increases and many other urban problems that lead to the search for solutions for the development and implementation of innovative, energy-saving and low-carbon technologies.

An example is the WiFi4EU³ initiative through which the European Commission promotes free Wi-Fi for citizens and visitors in public spaces such as parks, squares, public buildings, libraries, health centers and museums throughout Europe. In this way, everyone can be connected regardless of where they live. According to the European Commission, 232 out of a total of 265 municipalities in Bulgaria have received a voucher for WiFi4EU.

Another example is the entry of radio networks on the Bulgarian market, which are intended for the implementation of the Internet of Things (IoT) - solutions related to air monitoring, garbage disposal, agriculture, management of the support networks for water supply and the energy sector.

In Sofia, the service for shared trips with electric scooters is now available with the idea of freeing up and reducing traffic in the central parts of the capital, which allows the use of fewer private cars, which in turn would improve the environment and the urban way in the long term

³ European Commission. WiFi4EU. Free Wi-Fi for Europeans. Available from: <https://wifi4eu.ec.europa.eu/#/home> [accessed 01 January 2023]



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of life. In less populated areas, the process of implementing smart and innovative technologies is at an early stage.

It is necessary to work in the direction of improving the infrastructure, the use of innovative and low-carbon technologies and improving the knowledge and awareness of citizens about smart decisions and how to be sympathetic to the improvement of the areas and neighborhoods where they live.

Out of a total of 118 ranked cities, Sofia is only in 107th place, according to the annual report prepared by the Institute for Management Development at the Singapore University of Technology and Design (SUTD). Smart cities are ranked based on economic and technological data, along with their citizens' perceptions of how "smart" their cities are. Every year more and more cities are added to the survey. In 2022, the first places are headed by Singapore, Zurich and Oslo. The list also included cities such as Leeds and Glasgow in the UK, Bordeaux and Lille in France, Kiel in Germany, Medina in Saudi Arabia, Istanbul in Turkey and San Jose in Costa Rica.

According to the results of the Smart City Index 2022⁴ ranking, there is much to work on in Sofia, both structurally and technologically, in the areas described below:

Health and safety: The sanitary conditions in the poorest areas, the provision of medical services, the cleanliness of the air, etc. are rated low by the local population. A major problem here is the lack of online reporting of problems in the city to ensure quick solutions. There is a lack of platforms and website to allow residents to easily get rid of used and unwanted items. Public safety is also rated low.

Recycling: Services related to recycling are also rated low.

Mobility: The main problems are traffic jams, unsatisfactory public transport, lack of applications for traffic flow awareness to reduce congestion, as well as pointing to free parking spaces to save time. Activities related to the utilization of green areas are still in their initial stages.

Government sector: the city receives a very low score for the criterion "easily accessible information about local government decisions ". Residents contributing to local government decision-making and providing feedback on local government projects are also rated low. Online public access to city finances and platforms where residents can offer ideas to improve city life are also rated low.

It is also important to note that national and local governments have a crucial role in the development of smart cities, and the role of each resident is paramount in solving urban problems and adapting to climate change. An example of this could be the voluntary participation of residents in smart city and technology initiatives, encouraging friends, family and colleagues to use bicycles, play sports, participate in landscaping and tree planting initiatives, promote urban vegetable gardens, clean and maintaining inter-block spaces, supporting and creating local art, production or business related to bio- and natural products, etc.

⁴ Institute for Management Development, and Singapore University for Technology and Design (SUTD). 2022. Sofia, Smart city ranking [online]. Available from: <https://www.imd.org/smart-city-profile/Sofia/2022> [accessed 01 January 2023]



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INSIGHTS FOR AN URBAN INFILL ARCHITECTURAL CONCEPT: THE CASE OF CHUECA/ MADRID

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ABSTRACT

Chueca is a vibrant neighbourhood located in the heart of Madrid, Spain. It has become one of the most favored areas in Madrid for both the local community and visitors because of its lively atmosphere and cosmopolitan character. Chueca's urban landscape is characterised by significant architecture, integrating historical buildings and modern design structures. Chueca's narrow streets are lined with picturesque balconies, colorful facades, and hidden courtyards, creating an enchanting ambience. The neighbourhood's urban planning and design encourage pedestrian-friendly streets, allowing the local community and visitors to explore its charm on foot and truly immerse themselves in the captivating atmosphere. This project paper attempts to present an urban infill case study in a characteristic area of Chueca. The accessibility and circulation central concept of the project allows for interactions between these different user groups. The paper illustrates how the applied design concept of the project can hold temporary and permanent events through its functional programs according to the needs of the site, the local community, and the visitors. Thus, this can assist in achieving a socially sustainable interaction within the local community while maintaining the particularity and the needs of specific project users.

Keywords: Social Sustainability, Local Community, Circulation Concept, Temporary and Permanent Programs, Pedestrian-Friendly Path.

1. INTRODUCTION

In many world cities, approximately everywhere, an older city core represents a unique historical link with the past. These historic cores are surrounded by modern urban structures (Haddad and Fakhoury, 2016). However, due to their fast growth and transformation, their social structure and economics present a genuine challenge to their natural and cultural resources. Urban settings and features, such as buildings, paths, streets, neighborhoods, and green open spaces, exert continuous influence on the quality of urban areas, thereby shaping cities as more or less livable, where residents can access the quality of life in their neighborhood, offered by the private and public service provision.

In the case of the urban historic cores, the historic houses are the most critical evidence of the past lifestyle (Fakhoury and Haddad, 2016). They are "the physical manifestation of the social and cultural traditions which have developed to give the modern city and society its meaning and character" (Steinberg, 1996, p. 465). Understanding, thus, the change in urban development is critical in studying urban dynamics, managing resources, and providing services in these rapidly changing built environments (Al-Khader et al., 2009; Haddad and Fakhoury, 2016).

Considering such aspects leads to a better understanding of the dynamics of urban heritage change and its role in altering the cultural landscape. According to the Burra Charter (ICOMOS, The Burra Charter, 1999), one negative impact is represented in the destruction and removal of

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the urban heritage with cultural significance⁵ for new construction. This situation is more evident in the capitals, where the fast pace of urbanisation mainly threatens different archaeological and cultural heritage (CH) resources, where the nature and direction of urban change today are more dependent on the globalisation effects and economy than ever before.

Many major historical areas and heritage sites distinguish many capitals in the world, some thousands of years old; these are often located mainly adjacent to the old city centre and are now surrounded by contemporary urban structures, as in our case, in Madrid (Figure 1). Madrid City represents a real example of the interaction between modern and urban heritage sites and urban landscapes.



Figure 1. Aerial photo of Madrid City. The blue circle in the centre of the photo shows Chueca.

Chueca is a vibrant neighbourhood located in the centre of Madrid (See Figure 2). It has become one of the most favoured areas in Madrid for both the local community and visitors because of its lively atmosphere and cosmopolitan character. Chueca's urban landscape is characterised by significant architecture, integrating historical buildings and modern design structures (See Figure 3). Chueca's narrow streets are lined with picturesque balconies, colourful facades, and hidden courtyards, creating an enchanting ambience. We can see a connection and integration between historical and modern buildings simultaneously. They can be in the same building with different uses (See Figure 3) or in the same street. The neighbourhood's urban planning and

⁵ Cultural significance means aesthetic, historical, scientific, social, or spiritual value for past, present or future generations (article 1.2).

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design encourage pedestrian-friendly streets, allowing the local community and visitors to explore its charm on foot and truly immerse themselves in the captivating atmosphere. An interesting landmark of the area is the Architects Association (COAM) modern building, one of the first projects on the site, connecting the site that links two parallel streets together. However, the community can also use it because it is characterised by a significant landscape and intelligently integrating historical and modern buildings (Figures 2 and 3).



Figure 2. Part of the Chueca neighbourhood located in the centre of Madrid, the Architects ' Association building, with the white V shape colour and the project site

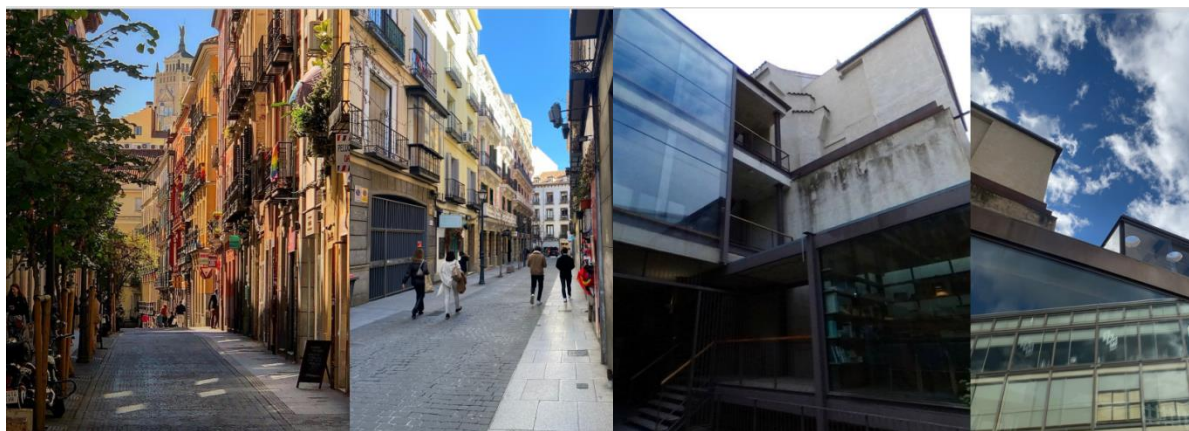


Figure 3. Images of Cheuca's narrow streets that integrate historical buildings and modern design structures in the study area on the left and images of the Architects ' Association building on the right.

This project paper discusses the case study mainly conducted as part of the design project at IE University in Spain to propose a regenerating infill project at the Chueca historic district within the Historic urban core of Madrid (Figure 4). The proposed design aims to provide special consideration and functional programmes for significant locations within the study area. In brief, the study aimed at developing the critical infill building project, within a culturally significant area and its main related open space, to serve as a centre for IE youth, diverse local users and visitors. It attempts to organise an urban infill project as a case study in this characteristic area of Chueca, based on increasing the accessibility and pattern of circulation as integral approaches for the concept, to allow for the interaction of the different user groups. As in the case of the Architects ' Association building project, which allows for two parallel streets to interact with each other, this proposed design project adopts further this idea, emphasizes it

and allows for a connection between two other parallel streets, thus integrating the accessibility for four streets to host different user groups. The only object blocking this was an empty small house without cultural significance. For this project to happen, this building had to be demolished (Figure 4). The adopted accessibility and circulation concept in this project allows for interactions between these different user groups. The paper also illustrates how the applied design concept of the project can hold temporary and permanent events through its various programmes according to the needs of the site, the local community, and the visitors. Thus, this can assist in achieving a socially sustainable interaction within the local community, while maintaining the particularity and the needs of specific project different users.



Figure 4. A detailed photo showing Cheuca's Architects Association building on the left and the project study area on the right

2. MATERIALS and METHODS

The paper shows the increasing need for studying how to deal with the interaction between infill modern projects, heritage setting and urbanscapes, while maintaining a socially sustainable urban heritage fabric since the project has a critical location in the historical neighbourhood of Chueca in the centre of Madrid. Of importance is to consider that the image of the cities that have "grown historically over the centuries cannot be put on ice during conservation" (Deslagen, 2009). Meanwhile, Cherchi (2015, p. 269) shows how reusing abandoned edifices and outdoor open spaces "constitutes a significant opportunity for achieving more liveable and healthier cities through the regeneration of inner-city areas". A place is considered livable when designed to ensure safety, promote health, attract a diverse range of users, and fulfil their diverse needs (Southworth, 2005). The livability and quality of a place concept is related to development centred on the predominance of a street life, a sense of urbanity, walkable neighbourhoods, and linked communities which enhances urban 'livability' and is strongly supported in current practices (Beattie and Haarhoff, 2018). The practice of Infill urban heritage projects and management, however, is an essential tool to create a balance between the preservation of the character of existing heritage and the changes brought by the urbanisation process in the context of the overall capital local community and visitors' needs and the needs of the site to achieve social sustainability. Socio-cultural sustainable redevelopment of historic urban environments should make spaces for local people rather than preserve certain traditional forms as cultural symbols. Still, some traditional forms that evolved from collective memory and traditions can be widely reused with community involvement in

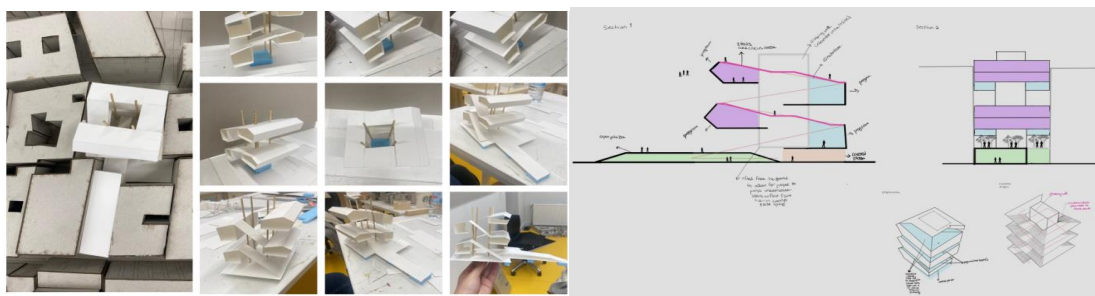


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architectural and urban regeneration (Fakhoury and Haddad, 2016). A careful decision-making process in these infill projects is required to reach a satisfactory policy in a complex urban heritage environment. The methodological approach of this research in this infill project is infusing this historic area with its full role as a place of living, socio-economic and cultural creation, and shared enjoyment and memory. Thus by utilising compatible activities, we can enhance it. Attracting the youth and university students to visit and arouse their interest to provide further to the local cultural identity could thus restore and add to the site's collective memory. A complete site survey was conducted for the area under study, forming the Chueca historic neighbourhood and the adjacent area, combined with a detailed photo survey and Model of the relevant components in the urban environment (See Figures 3 and 5). The well-documented photo survey of the significant street elevations and sites of interest facilitated a better interpretation of the identified physical and non-physical patterns and their locations. The visual image of Chueca's historic neighbourhood offers a variety of values and sense to the understanding of the physical space by the imagery it attributes to it, thus one recognises the key culturally significant elements of the urban fabric and formation of Chueca. The effort presented in this paper falls mainly in two directions: first, identifying the different aspects of the currently existing situation of the selected site and adapting to new urban practices within the surrounding area while considering its impact on the existing urban heritage of the area; and second, proposing several functional suggestions and solutions to enrich and empower the current situation. Hence, enhancing the pedestrian network at the project site can benefit the local community's quality of everyday life and its visitors (Figure 5). Specific trails and intersections at the site could also elevate the locals' and visitors' visual and aesthetic experience. This can greatly support the potential visitors' attraction. The project also illustrates how the poposed programmes of a circus, rythmic gymnastic, workshop and exhibitions, spa and research spaces in addition to the network of open spaces, climbing and green surfaces can hold both temporary and permanent events throughout, even addresses day and night, reflecting the needs of the site, the local community, and the visitors. Thus turning it into a connecting vibrant attraction, achieving further social interactions for the local community, while maintaining the particularity and the needs of diverse project users (Figure 5).





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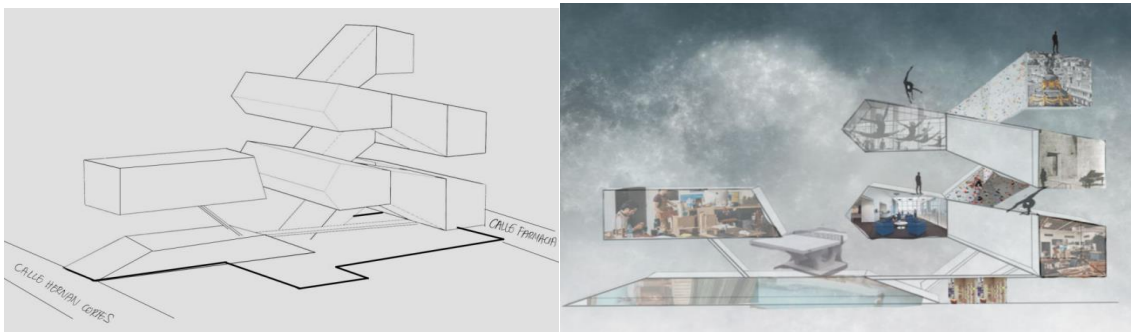


Figure 5. Photo and illustrations showing the process models of the project idea with the hidden court's main characteristic of the Chueca area and the concept of spiral circulation flowing vertically to accommodate different suggested activities.

3. FINDINGS and DISCUSSION

The project presents a brief discussion and evaluation of the existing conditions of the current urban context and urban formations, based on a rapid assessment and observations by the author of this paper, who was involved in different activities and analytic studies concerning Chueca during 2022-2023. The built-up area and urban fabric of the site surroundings are dense, with hidden small open courts. Historic buildings of different eras form the continuous main facades of the vibrant streets, in addition to modern buildings such as the Architect's Association building. Additionally, the area hosts diverse communities and is vibrant.

This part lists the proposed urbanisation infill design aspects associated with the urban development process in Chueca, while considering its impact on the historical asset. It focuses on analysing, evaluating, and proposing a socio-cultural node related to enriching urban accessibility; it also presents the concept of developing this site by the conception of linking two adjoining parallel paths or streets to enhance and empower the cultural significance of the urban tissue, while not allowing any activity that may cause deterioration to its value within the context of heritage buildings. This paper supports rethinking the role and intentions of infill projects in heritage neighbourhoods, so as not to only protect the initial zoning/boundary of any heritage block, but create a connection between streets and adjacent spaces which can enhance and infuse the cultural significance of this urban tissue. This proposed infill suggests a sustainable project approach in this historic neighbourhood by presenting itself as a civic landmark and a cultural and a social meeting place, capable of strengthening the civic characteristics and, at the same time, allowing dynamic relationships in the lives of its citizens and visitors. Living in this area can be sometimes stressed, and what is needed is a direct intervention in the physical structure of the selected site to convince people- and especially decision-makers - that it is a thoughtful attempt to stem the decline of some urban empty spaces and reinstate it as a core site in Chueca for 'people'. In addition, traditional and historic architecture can still be transformed according to the socio-economic conditions of each specific era requirements because it is "a living organism that grows over time, and it cannot be put on ice during conservation" (Philokyrou, 2015, p. 120; Haddad and Fakhoury, 2016).

Figure 5 shows the process models for the project idea. The concept of the suggested building matches the surroundings with the hidden court's main characteristic of the Chueca area. According to Fakhoury and Haddad (2016, p.2), traditions that have progressed into traditional forms can be widely used and reused "in contemporary architectural and urban design projects,

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with proper community involvement". This can be understood if we accept that re-functioning historical and traditional structures to modern practices is only "a tool for carrying the traditional environments into the future, both physically and socially". However, the actual task is to be ingenious "to imagine uses which offer intellectually stimulating options, in the belief that the production and consumption of cultural goods, of art, could constitute business, could ensure adequate economic returns, changing and evolving the common commercial standards" (Giani et al., 2015, p.45).



Figure 6. Collage poster of the concept reflecting the repair program based on a spiral circulation towards the roof top, and sketches of the diverse circulation and stairs 'use patterns and their various programmes/functions'.

Of importance is to emphasise that the project programmes were designed for uses which offer intellectually and physically stimulating options and deal with different users' by providing temporary and permanent events; meanwhile, the central concept is allowing for interaction from both parallel streets and, therefore, creating connections to four parallel streets altogether, thus allowing for the diverse users to interact including the local community. Figure 6 shows a collage poster of the concept reflecting the repair program based on the circulation concept and urban accessibility approach and intelligent functions. As in our case, the continuity of the pedestrian movement between two parallel streets flowing onto the roofs and spaces would



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enhance the user experience. Thus, a network of pedestrian routes flow into the site linking the different neighbourhood streets and district. One of the main outdoor functions is a circus and outdoor Exhibition. Meanwhile, on top of the building is a designed platform area to view Madrid from the top, thus liberating the public access to the roof. A Spa, studios and workplaces are connected by stairs and ramps. Figure 6 also illustrates sketches of the circulation approach of both interior and exterior urban stairs and their various functions targeting both specific users or public at large.

Figure 7 illustrates the different plans of the project and their levels within the site. The ground floor plan is open to the public so that one can pass through the project from one street to the parallel street. There are diverse functions accommodated on each floor or atop of the roof of each floor; the internal spaces have diverse functions like exhibition halls and working spaces. Figure 6, 7& 8 illustrate the idea of connection and urban stairs. The sections through the different levels, both urban stairs and internal and external stairs allow a continuous circulation connecting the ground floor, to the roof, where the user can either access the project functions, cross to the other street or move from one space to another.





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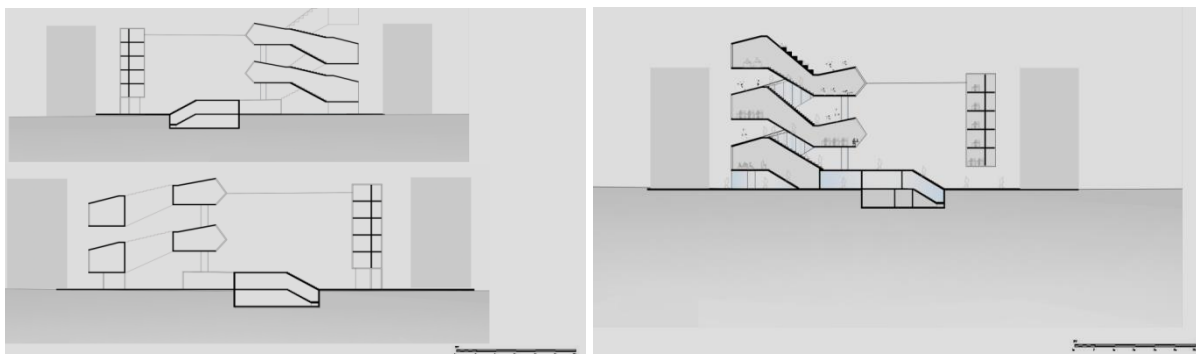
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Figure 7. Plans of the different levels of the project within the site

In Figure 8, the different sections display the courtyard where its primary purpose is to match the urban typological tissue, but it also hosts the circus performance in the project, which is one of the permanent outdoor functions. As mentioned before, permanent and temporary programs are found both in the centre and around the circulation on the stairs. These diagrams and sections illustrate public access from the ground floor, through the circulation on the exterior stairs to the roof, for both the general public and the local community. On the other hand the interior spaces are specifically targeted for certain users; as shown in Figures 7, 8 and 10.

The selected material for the facades is glass panels with divisions of concrete to reflect people's interactions and experience the different elements of the exterior spaces. To summarise, the project's design and content are for temporary and permanent events, with functions and programs accommodating the needs of diverse users and the local community, while creating a new view to Madrid from the rooftop to view and enjoy the city. The created active connection between the two parallel streets will also enhance and empower the cultural significance of the urban tissue.





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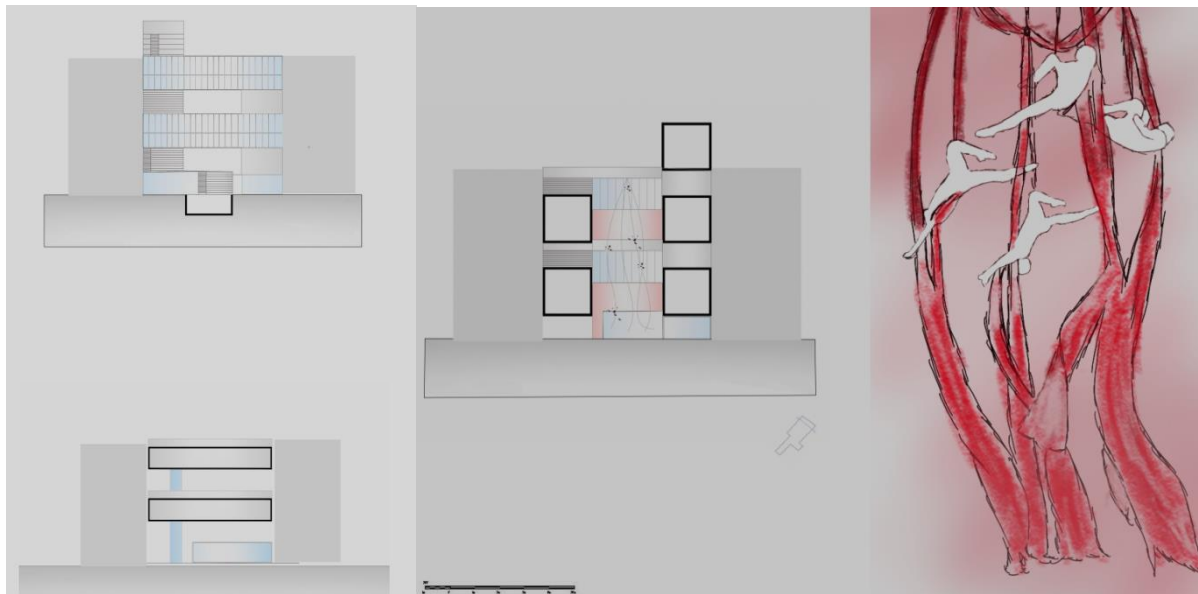


Figure 8. Different sections of the project building

Finally, Figure 9 illustrates a schematic representation of the facade elevation of part of the street in the project area. So, this building, although it does not match the same morphological facades style, matches the same integrity of the typological urban tissue of the area.

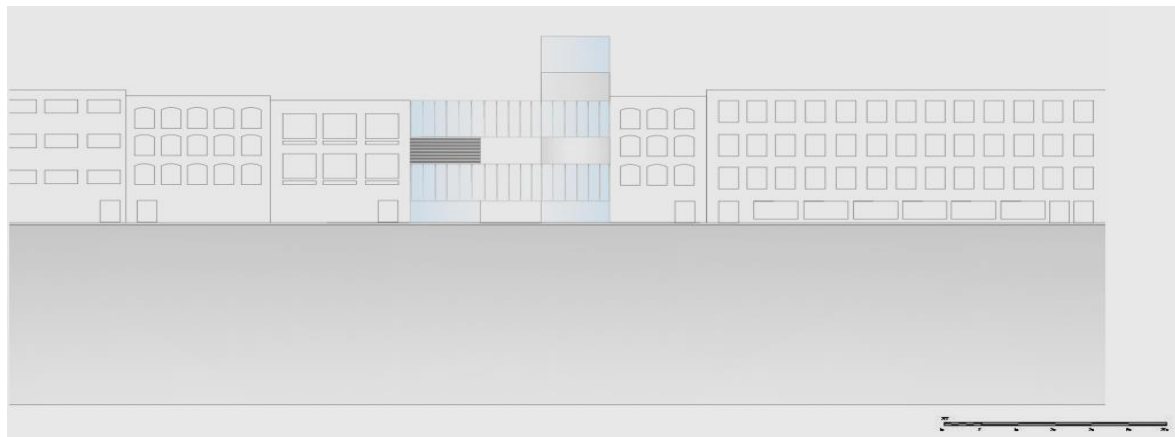
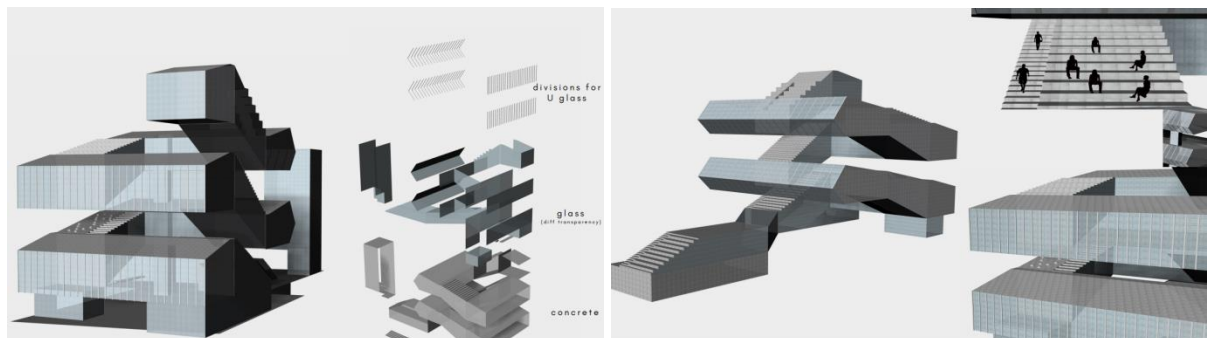


Figure 9. Schematic illustration of the facade elevation of part of the street in the project area

Figure 10 illustrates different shots clarifying the process of developing the project's final image and primary material (glass and concrete).





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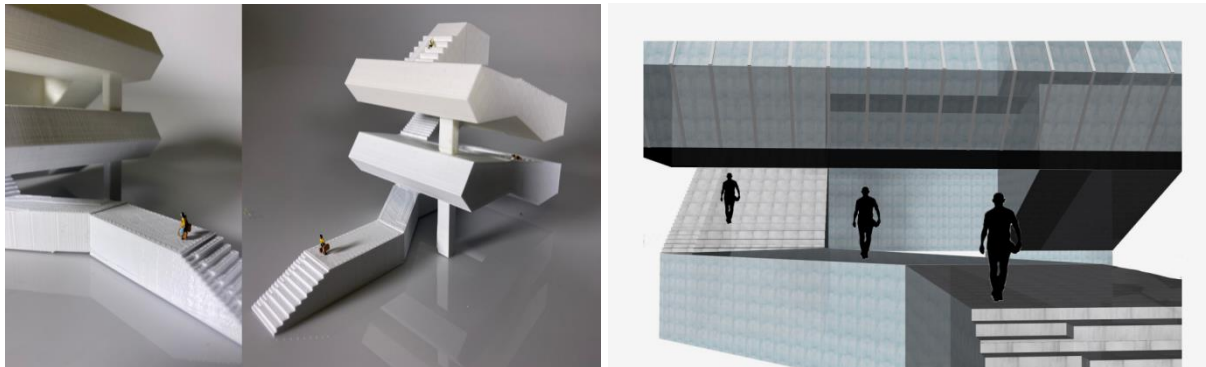


Figure 10. different shots showing the process of developing the final image and primary material (glass and concrete) of the project

Therefore, to enhance the visual image of the historical cores, the task of architects and planners is not only to preserve prominent elements, particularly the façades of some historical settings and adapt them to imitate the more positive aspects of modern life but also to preserve the integrity values and the community collective memory while upgrading the elements to fulfill their modern life standards and expectations. Also, creating green landscapes as public outdoor open spaces to help the local community and enhance pedestrian connectivity are critical and essential issues for the infill action plans.

However, "the image of an existing building or historic centre is not static but is constantly subject to changes" (Philokyrou, 2015, p. 11). Where structure replacement is required, as it sometimes is, on structural or health grounds or both, this should agree with the existing character of the units. In infill projects, replacement buildings must be of proper scale (See Figures 9 and 10); otherwise, the units will miss their identity if the street lines remain unchanged (Whitehand et al., 2011). In addition, the characteristics of the selected places should be thoroughly analysed. Accordingly, their specific characteristics should be established by respecting their role in the traditional context (Dincyurek and Turker, 2007).

To conclude, a compatible and sustainable use of the historic core is only possible by filling these historic cores with its complete role "as a place of socio-economic and cultural creation, shared enjoyment, and memory; as a leading strategy" (Haddad and Fakhoury 2016, p.49). On the other hand, as the historic urban area continues to grow, as will the related financial, socio-cultural, and other problems, treating the physical manifestation of such problems as also the infill approach in isolation increases the danger that the impact of a conservation policy will conflict with local needs, expectations, or resources (Steinberg, 1996; Haddad and Fakhoury, 2016).

4. CONCLUSION and RECOMMENDATIONS

In the framework of the above discussion of the problematic aspects of infill projects, the adapted practices and policies in the Chueca area in the heart of Madrid and the imposed effects on the heritage sites, it will be beneficial to point out some recommendations and solutions. Infill design projects in the historic core can show a genuine role as an emerging place of interactions between the modern fabric site and urban heritage locations. The paper presents some of those ideas to improve the urban system in the study area in a sustainable way that balances the protection of the existing heritage and the sufficient planning of the modern urban area. A vital issue to be considered in the infill projects and urbanisation centres, as in the case



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of this paper, is to ensure that any development near such sites is under control and to minimise the negative impact of negative modern infill and out of scale structures. A balanced cultural and urbanscape system can be obtained to integrate better heritage and modern infills in cities.

Any new development plans must provide sufficient open spaces in high-density urban heritage areas for green and outdoor spaces, parking areas and other essential uses. There is a need to raise the total of outdoor open spaces in the urban system to balance the environmental system for a socially sustainable environment. The presence of empty open spaces or neglected constructions in inward and inner block locations through the study area, accessed through indirect paths within the historic city blocks, has the potential to create public open spaces or enclosures within the blocks as illustrated in the design of this Chueca proposed project, where creating an urban connection between two parallel paths or streets can enhance and empower the cultural significance of the urban tissue.

This can strengthen the quality of life in the heavily historic urbanised quarters and initiate new places of interest for residents and tourists' routes and activities (Haddad and Fakhoury, 2016, p. 49). In this sense, the potential of the redesign of elapsed urban spaces is outstanding: "Covered spaces offer new opportunities for regenerating a city, engaging in new relationships, building new squares, and activating new, unexpected connections between the different parts of a city" (Cherchi, 2015, p. 257; Haddad and Fakhoury, 2016).

Finally, digital analytical tools and socio-cultural concepts can enrich and enhance the conventional infill methods utilised in such sites to ensure the social sustainability of urban settings and their authenticity, integrity and cultural significance, such as GIS, digital mapping systems, and AI that could link spatial and non-spatial data of the typological and morphological aspects of structures and landscape features to assist in recommending of how to deal with the different urban features, besides their role in 3D modeling the infill urban process and its effects on the heritage urban fabric. Meanwhile, combining public participation in integrated conservation and planning policy should benefit all parties (Yung and Chan, 2011).

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THE APPLICATIONS OF SUSTAINABLE TOURISM AND INTERVENTIONS FOR THE PRESERVATION OF THE ARCHEOLOGY AND HERITAGE OF HISBAN

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ABSTRACT

This research paper focuses on the restoration, presentation and preservation of Hisban; an archaeological site in Jordan, while integrating local community involvement and adopting sustainable tourism practices. The project aims to protect both the tangible and intangible heritage assets of Hisban by developing a sustainable tourism attraction that showcases the site's rich interconnected layers. By reusing buildings from the Ottoman era and infusing new meanings into the existing spaces, a comprehensive narrative is created, bridging the past into the present. The project recognizes the significance of the local community identity, particularly as farmers deeply attached to their heritage. The proposed sustainable tourism attraction aims to meet the demands and needs of the local community, while fostering positive interaction between the community and visitors. The research explores strategies for adaptive reuse, spatial understanding of open spaces, restoration of existing façades, and interpretation displays within the buildings. Additionally, the project incorporates hiking trails that expand the visitor experience to encompass the hydrological and agricultural values of the area and its surroundings. Phased implementation allows for the adaptive reuse components to generate funding for subsequent stages, supporting the sustainable development of the community and the heritage site. The project emphasizes the use of sustainable materials, light interventions, and the preservation of the present narrative of the local community. Through its holistic approach, the research paper presents a comprehensive plan for transforming Hisban into a community-engaged tourist destination, preserving its heritage and fostering local identity and facilitating interactions between visitors and the local community.

Keywords: Sustainable Tourism, Heritage, Archeology, Local Community, Adaptive Reuse, Jordan, Agriculture, Hisban.

1. INTRODUCTION

Discovering Hisban's Rich Heritage

The project unfolds within the quaint village of Hisban, nestled on the outskirts of Jordan's capital, Amman. Hisban serves as a pivotal nexus connecting Amman and Madaba, boasting a landscape adorned with predominantly single or double-story buildings. Rooted in history, Hisban has a deep association with agriculture and farming traditions, characterizing its essence throughout the ages.



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Central to Hisban's historical tapestry is its archaeological site, spanning from the late Bronze Age to modern times. This archaeological treasure is currently under excavation by Andrews University, known as the Hisban Archaeological Park and in cooperation with the Department of Antiquities. Within its precincts stand vestiges of a Byzantine church, a Roman temple, a Mamluk palace, and an Iron Age reservoir. Moreover, the village harbors numerous archaeological sites awaiting comprehensive excavation. Notably, Hisban once served as the capital of "Belqa" during the Mamluk era, emerging as a pivotal hub in the sugar trade industry during that epoch. The timeline is visually represented in Figure 1. (*Madaba Plains*)

The revelation of an Iron Age reservoir has drawn our focus to the hydrological dimension of this site. Extensive research has unveiled the presence of multiple cisterns, reservoirs, and water wells in the vicinity. Adjacent to the site flows a stream coursing through the valley, linking Hisban to Seil Hisban, the Jordan River, and culminating at the Dead Sea (Jones, 2003).

The zenith of Hisban's prosperity manifested during the Byzantine period, marked by the construction of three churches of profound religious significance. Notably, a bathhouse emerged on the western fringes of the church, crowning the archaeological site's summit. Remarkably, water systems from antecedent civilizations, such as the Iron Age reservoir and Roman cisterns along the plateau, continued to serve the community during this era (Jones, 2003).

In the Abbasid period, Hisban played a pivotal role in the Green Revolution, introducing over 20 new floras to the region and implementing crop rotation practices. The swift adoption of these agricultural innovations hinged on the sustainability of the water systems inherited from prior civilizations. The preservation and adaptation of these systems underscored their critical importance in sustaining these transformative processes (Jones, 2003).

During the Mamluk period, Hisban underwent refortification and ascended to the status of the capital of "Belqa." It assumed the role of safeguarding the Mamluks' economic interests as a lucrative agricultural epicenter, supplying provisions to pilgrims on route to holy sites and mediating complex political affairs. Moreover, it served as a prominent distribution center for the sugar trade industry, seeing the passage of trade caravans laden with diverse commodities (Jones, 2003).

The Ottoman period bore its share of tribulations for Hisban, yet in 1889, a resurgence occurred with the reconstruction of mills in the Jordan Valley and Palestine. This era witnessed the construction of several enduring edifices, a subject elaborated upon in the later sections of this research paper (Jones, 2003).

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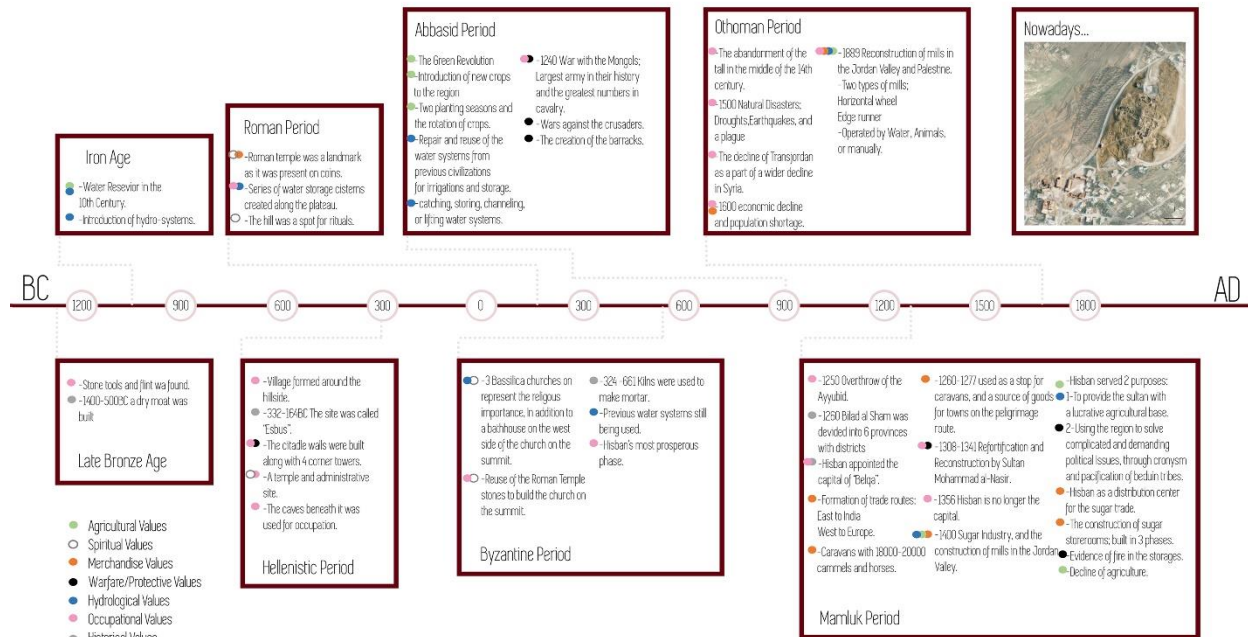


Figure 1. Detailed timeline of Hisban. (Madaba Plains)

Project and Community Context

-Local cultural assets:

Hisban is a very well-known agricultural village located on the southern outskirts of the capital Amman. The location forms a node that connects two cities: Amman and Madaba. Also, it is close to the airport. (Madaba Plains)

The archaeological site is on the village's highest summit which gives a clear undisturbed view of the valley on its west.

The local community was noticed to have a great interest in horses and horse riding, which dates back to distant history within the region.

The local village is occupied by mainly 3 families. The locals are very friendly and approachable people. Who are used to receiving visitors in their village, since Andrews University excavations take place annually within the village. (Madaba Plains)

Site Selection and Existing Buildings

The site selected for development and interpretation was the zone holding the Ottoman buildings, where protecting those buildings will help preserve part of Hisban's history. The Zone shown in figure 2 contains several buildings. The buildings' physical condition had to go through an assessment to create an appropriate understanding for the proposed interventions.

Ottoman Complex and Heritage Assessment

In this section, an overview of the Ottoman complex at the archaeological site is provided. Specifically, the focus will be on the eastern and western sections of the courthouse, the stables,



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the Mamluk tower, a family house and Al-Qasr, where an evaluation of the historical and architectural significance of these structures was conducted.

Courthouse: Eastern Wing. The eastern part of the courthouse served as a guest house and currently includes a storage area to accommodate local farmers' agricultural tools. Evidence shows that the eastern and western parts of the courthouse were connected. The structure of the roofs is constructed out of cross vaults, currently with a deteriorated interior. Notably, the eastern elevation and its extension showed signs of deterioration. Interestingly, the doors and windows have kept their structural integrity despite the internal deterioration (Carroll, Fenner, & Labianca, 2006).

Courthouse: Western Wing. Similar to the eastern wing, the western section of the courthouse was also designated as a guest house and included a storage unit. Here, the detachment of architectural elements is more prominent, along with well-preserved stairs. Once again, the doors have withstood the test of time, while signs of detachment from the eastern part are more evident (Carroll, Fenner, & Labianca, 2006).

Stables: The stables were designed to house horses, with a dedicated circulation area and storage space for food and utensils. Our assessment reveals a structural failure in the ceiling, added at a later date than the original construction. Intriguingly, the eastern wall displays extruded arches, suggesting an earlier origin than the stables themselves linking these arches to the tower towards the south. Moreover, the western elevation exhibits a distinct craftsmanship compared to the other facades (Carroll, Fenner & Labianca, 2006).

Mamluk Tower and Citadel: The Mamluk tower served as a protective structure and is regarded as the oldest building in the vicinity. Nearby, remnants of a citadel were also identified. Supporting evidence, including the presence of an underground room, which was uncovered in a 2001 study. Among the architectural features, a barrel vault was identified. Notably, the area has evolved over time, and the current remains present a freestanding wall. Further excavation may yield valuable insights (*Madaba Plains*).

Family House A family currently resides in this structure, which includes a storage facility from a bygone era. The building's physical condition remains sound, and it is presently used as shelter for chickens.

Al-Qasr: Al-Qasr appears to have undergone construction in three phases. The initial phase involved storage spaces, followed by a residential area above it. Subsequently, an extension, known as a 'madafa,' was added. Al-Qasr showcases distinct craftsmanship, with differences in the stone used in the original and 'madafa' sections. Internally, significant deterioration is evident, with some cross vaults having collapsed. Although several doors and openings maintain their integrity, others require attention. Currently, the interior serves as a communal space for animals and other purposes (Carroll, Fenner & Labianca, 2006).

Analyzing Spatial Values Through the Nara Grid

Subsequent to the comprehensive physical assessment, the application of the Nara grid methodology proved instrumental in elucidating the intrinsic values embedded within the designated zone. The values in our assessment included Historical, Ambient, Conceptual and Artistic. This analysis identified three principal outdoor congregation spaces, each serving distinct functions: spiritual activities, social interactions, and the hosting of celebrations and events. A visual representation is represented in Figure 3.



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Notably, the community of Hisban presents unique sociocultural characteristics, exemplified by the prominent presence of horses within the village environs. These equine companions, frequently encountered during strolls through the village, serve as both essential modes of transportation to neighboring locales and indispensable aids in the cultivation of agricultural lands.

In the annals of Hisban's history, the year 1970 marked a significant juncture as Andrews University initiated archaeological excavations within this historically rich enclave. This pivotal undertaking fostered collaborative relationships between local Jordanian authorities and international educational institutions, signifying the inception of valuable partnerships that continue to shape the site's exploration (*Madaba plains*).



Figure 2. The result of the physical assessment.



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Figure 3. The Visual representation of the Nara Grid.

Site Appraisal & SWOT

The site offers a great opportunity to help the present village economy and save important buildings which played an important part of Hisban's heritage. The project also holds many interesting natural features which are explored in the design section of this research paper. Also, this selected site seems to hold the different layers of historic data-documentation to serve as an interpretation center. The SWOT revealed that the site can create a historic landmark. The SWOT analysis is shown in figure 4.



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SWOT Analysis	Strength	Weakness	Opportunities	Threats
Location	Naturally forms a node that connects to 2 major cities in Jordan. And its of very close proximity to the airport. <u>Also</u> VERY close to the main GJU campus in Madaba. Well established archaeological site with an extended area, that is connected to important routes.	The infrastructure of the area is not the best.	Using the Historic values of the area to ignite tourism. Bring in the students from GJU.	Not well known to the youth. Slippery roads during rainfall. Bad infrastructure.
Social	The community in the area are very friendly, and the families have a close relation with each other.	-Each "ashera" forms a closed community	Helping the local communities by involving them in the project.	On the lower end of the Socioeconomic scale.
Economy	The economy of the area comes from the government employment, and agriculture.	The site does not benefit from the historic layer of the area for revenue.	Creating a tourist attraction that can bring more income to the locals.	
Archaeological	Deep history, well documented site. From the iron age up until modernity	It's not a <u>well known</u> location.	Teaching about a new historic landmark that's not very well known.	Urban sprawl intervening on the historic structures.

Figure 4. SWOT analysis.

The Goal of the project is to protect the archeological site and the Ottoman Complex by disseminating information about the extended history of the area; gaining touristic recognition.

Objectives include:

- Develop the site as a sustainable tourist attraction point.
- Disseminating information about the historic layer of the area.
- Involving the local community and increasing their income; horse riders and farmers.
- Build on the farming potential in the area as part of agricultural tourism.
- Act as a catalyst for Andrews University's excavations.
- Achieve economical and energy sustainability.
- Increase the quality of the recreational image in the neighborhood.
- Link Between the Ottoman complex and the valley.

Market Demand Analysis and Building the Program

The functions of the project were selected based on their need in the area/region and for the project to run in a self-sustaining model. Additionally, they needed to fit within the concept of the project.



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The project's functions were introduced as a journey developed within the design phase. This journey started introducing the activities to the users and linking itself with the spaces on the site based on the values that each part projects. As shown in figure 5. Thus, the functions should reflect that information onto the visitor.

1-Accommodation Units

The number of visitors of multiple tourists' destinations were studied and the number of the Tourists by destination reached more than 100,000 international visitors annually. The aim was to pin the project on the trail. A weakness was identified in the number of hotels and accommodation units in Madaba, which necessitated that the project holds accommodation units. (Department of Statistics, 2016)

2- Visitor's Center

The visitor center was a crucial part of the project to enable the site to hold interpretations and be pinned as a tourist attraction point. This center also holds the interactive educational parts of the project, and gallery spaces.

3-Dighouse

This function will enable the site to become a catalyst for excavations with Andrews University. As the Madaba Plains Project that they are running does not have a specific space. Additionally, it will allow volunteers and locals to participate in the excavation process.

4-Community Stables

The stables will enable the locals to have access to food and equipment for their horses. Additionally, they can shelter them within. The horse riders can offer their services here to take tourists on hiking trials on the horses into the farmlands or to the water stream. Expanding the project benefits away from the village. The stables are also to include a vet to take care of the health of the horses.

5-Community Kitchens and Restaurant

The kitchen enables the international visitors to be introduced to food from our culture. By bringing them to the locals they can form together dialogues that will benefit the locals through the revenue from the restaurant.



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Activity Based Program

Activity	Type of Activity	Facility	Function	Demand for Function	Targeted Users
Overnight Stay	Leisure, Necessity	Accommodation Units	Spaces to accommodate Andrew's University Researchers and Tourists.	Lack of accommodation in the region based on data from the department of statistics.	Researchers, International Tourists, Local tourists
Assisting Excavations	Educational, Social	Dighthouse	Studying, reconstructing and preservation of archeological findings.	A catalyst for Andrew's University excavations.	Researchers, Volunteers
Horse Riding	Leisure, Educational, Social, Necessity	Community Stables	A space to accommodate the needs of horses for the community, and riding activities.	Lack of important requirements for horses in the village.	Local Community, International Tourists, Local Tourists, Volunteers
Cooking	Educational, Social	Community Kitchens	Cooking and eating activities with visitors and the local community.	Providing food for the accommodation, and forming a dialogue between the locals and the tourists.	Local Community, International Tourists, Local Tourists, Volunteers
Learning the Values	Educational, Social	Visitor Center (Interpretation Center)	Interpreting the values of the historic events that occurred in the village.	The protection of heritage.	Researchers, International Tourists, Local tourists

Figure 5. Project program.

Project Statement

Providing a journey for the visitors with different interactions and types of exposure; creating a sense of identity and belonging through the phenomenology of a series of activities and experiences. Pinning the project as a tourist attraction.

Concept

Creating 2 main zones of interaction. The valley and the complex; holding different qualities. The valley will hold the memory of life, activating the senses of the user in multiple ways throughout different activities within an open green space. The complex will hold the memory of Age, presenting information about the site within a trial of enclosed humble spaces. The journey educates users about three main parts; History, agriculture, and sustainability. Through multiple interpretations of diverse types within the site.

Forces and Form Generator

Multiple elements of the site shaped the synthesis of the design. Which are shown in figure 6.

1- A module was created from the size of the cross vaults existing within the buildings. This module created a grid which was spread on the site. Modules from this grid created solids or voids that formed the circulation throughout the site. Simultaneously these modules became interpretation points or functional spaces.

2-Natural exposed bedrock on the edge of the valley was preserved and was a vital landscape element connecting the different buildings within the project.

3-Rainfall simulation was carried out on the edge of the valley, recognizing the points where water collected naturally, and the modules formed water storage tanks in those locations.

4-Retaining wall chains were extended from neighboring farmlands into the site. Enabling a seamless transition within the landscape.

5-Urban sprawl of the village started to intercept the archeological site from multiple locations. The project aims to protect further expansion of the village into the archeological site's boundaries.

Form Generator - Forces Diagram

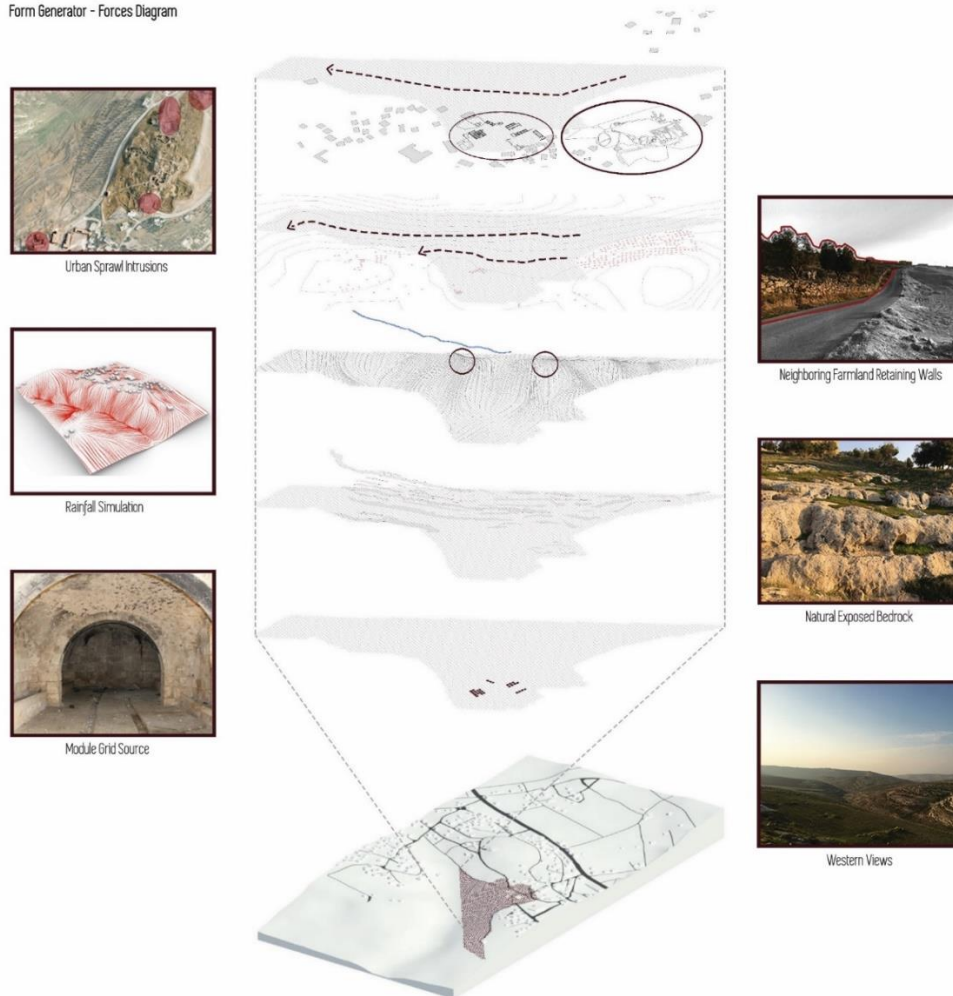


Figure 6. Form generation diagram.

Strategy and Parameters for Re-Use

Masses

1) Defining the volumetric understanding of the spaces through anastylosis.

-Lost volumes; steel structure abstraction.

-Collapsed vertical plains; steel structure and glass.

-Partially collapsed vertical plains; building up the volumes.



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Voids

- 1-Defining the edges where the buildings meet with the ground.
- 2-Leveling the topography to its original levels.
- 3- Interpretations on platforms created by the modules.
- 2) Restoration of the existing façade.
- 3) Interpretations within the buildings.
- 4) Light intervention with the ability to be reversible, due to the ongoing excavation process.

Synthesis

The proposed design includes two main zones: adaptive re-use zone and the expansion along the valley's ridge. The masterplan of the proposal is shown in figure 7.



Figure 7. Masterplan.

The journey starts at the re-use zone shown in figure 8. Circulating through the project, the user will be exposed to the different layers of the site through multiple interpretations as shown in figure 9.



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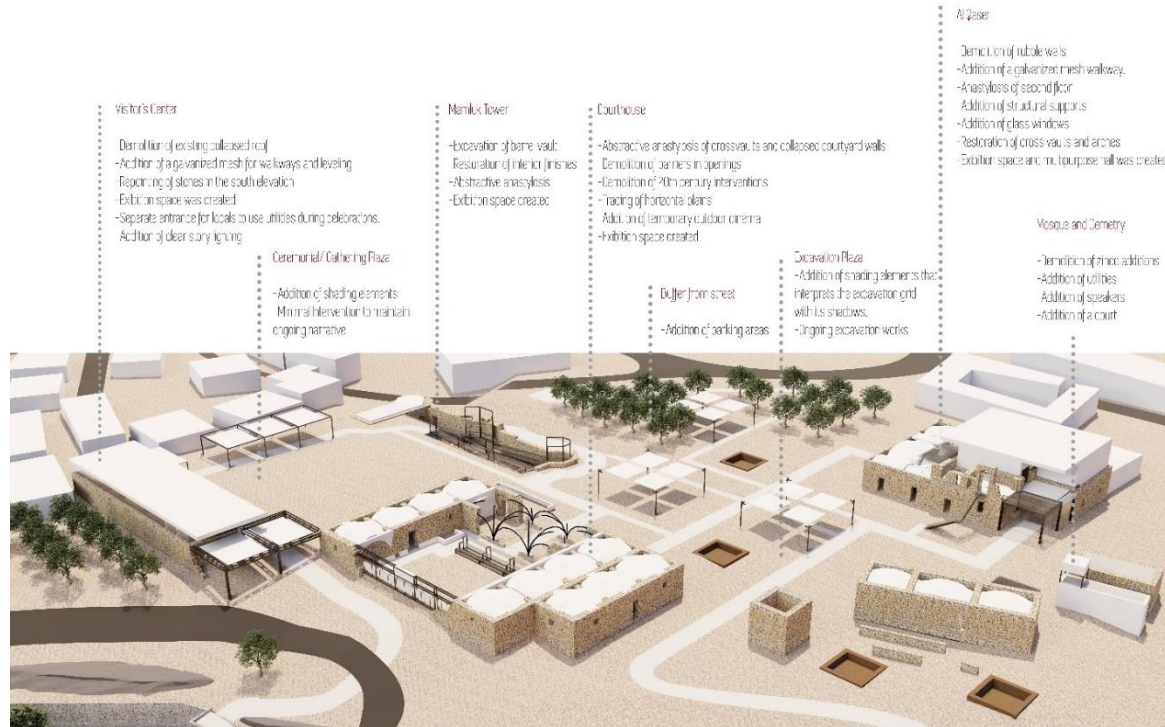


Figure 8. The proposed levels of intervention in the re-use zone.

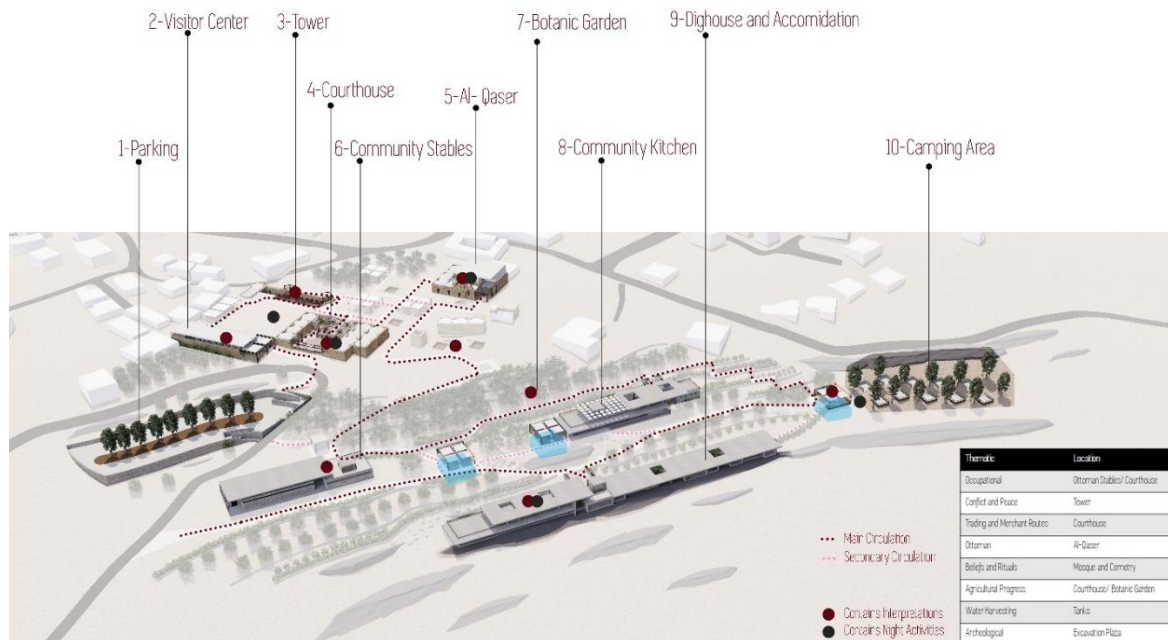


Figure 9. Proposed circulation and interpretation diagram.

Re-use Zone

-Visitors' Center: The initial steps included the demolition of a deteriorated roof and the addition of galvanized mesh for walkways and leveling. Additionally, the south facade required stone re-pointing to restore its structural integrity. Inside, an exhibition space was established,



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with a portion accessible to locals for gatherings and ceremonies. The gathering area underwent minimal intervention to maintain its celebratory ambiance. The interventions are shown in figure 10.

-Mamluk Tower: Excavations will take place, revealing the barrel vault. The outdoor spaces took into consideration the ongoing excavation process; hence a steel ramp will take the users into the vault as it will host an exhibition space. Anastylosis revived the lost volumes of the tower. The interventions are shown in figure 11.

-Courthouse: Abstractive anastylosis was applied to the collapsed cross vaults and walls. Barriers obstructing openings were demolished, along with 20th-century interventions; storage units and concrete water tanks. This transformed the courtyard into a multifunctional space, serving as an exhibition area in the morning and an open-air cinema at night. A buffer was introduced to separate it from the street. Shaded seating areas were added. The shading devices' shadows mimicked the excavation grid, with visible traces of ongoing excavations elsewhere. The building includes two exhibition spaces and a small seed bank. The interventions are shown in figure 12.

-Al-Qasr: Extensive restoration efforts were undertaken, including the demolition of rubble walls, addition of galvanized mesh walkways, anastylosis of the second floor, structural support additions, glass window installation, and the restoration of cross vaults and arches. Al-Qasr was reimagined as an exhibition space and multipurpose hall. The interventions are shown in figure 13.

Expansion Zone

Further down the valley, the landscape unfolds in distinct ways. To the east, the botanical garden is a close encounter with natural rock formations, fostering a tactile connection with geological elements. On the west, the panorama unveils breathtaking views, allowing visitors to engage with the surrounding landscape on a visual level. The pathways are constructed of a water canal that channels the rainwater captured into the water storage tanks created by the modules, that are topped with social seating areas.

The modules created the link to solve the leveling of the buildings on the ridge of the valley, they served as vertical circulation elements. And linking multiple functions within the same building.

-Community Stables: Staying on the planned route and user arrives at the roof of the stables. From there, they can see the horses through the slit between the two slabs and a part of the shop as an exhibition space formed from the module. Then they can directly enter the botanical garden without entering the stables. The design proposal is shown in figure 14. The stables will offer hiking trails for the visitors on horseback. Two routes were created for these hikes. The first explores the hydrological values of Hisban along the water stream. The second hike explores agricultural values through the farmlands.

-Community Kitchen: The user enters from the botanical garden into the terrace. Modules formed activity zones where the visitors can gather. Facilities in the southern part were included and can be used by campers in the camping zone. The design proposal is shown in figure 15 and figure 16.



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-Dig-house and Accommodations: Within this space, the workshop area comes into focus, providing insight into the activities and experiences of the researchers involved in the project. This area serves as a testament to the craftsmanship and dedication that went into the site's transformation. The design proposal is shown in figure 17.

At the same building we arrive at the accommodation area. The design of the accommodation hallway deliberately incorporates elements of the natural surroundings. It creates a semi-outdoor atmosphere, with features that frame the sky, permitting an infusion of natural light and the verdant hues of the adjacent greenery from the botanical garden. This approach ensures that occupants maintain a connection to the environment while experiencing the utmost comfort. The design proposal is shown in figure 18. Modules in this building created storage units for the workshops that function as display units simultaneously.

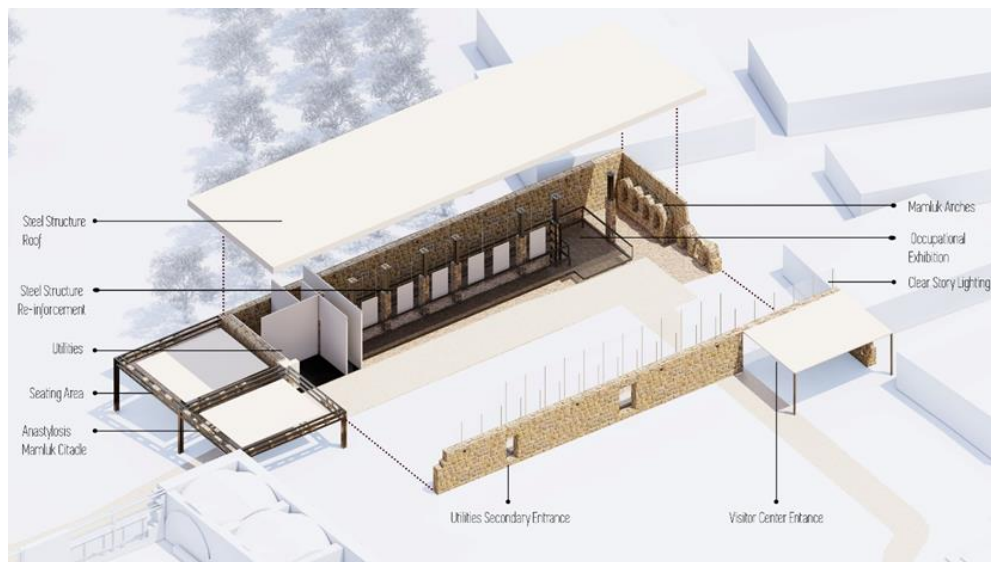


Figure 10. Proposed interventions for the visitors' center.

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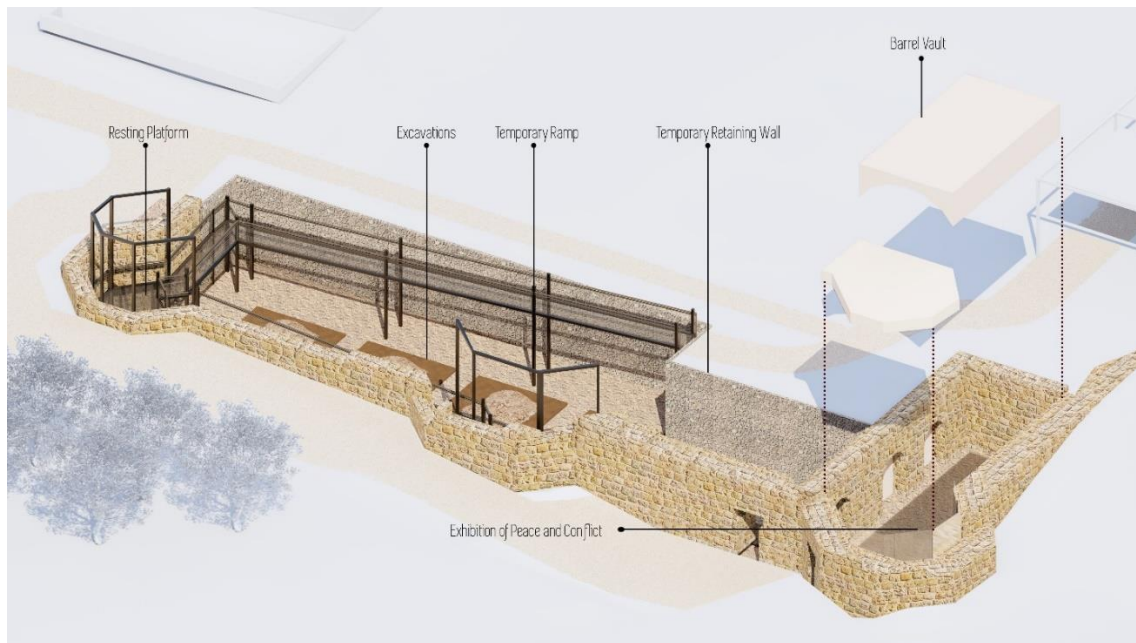


Figure 11. Proposed interventions for the tower.

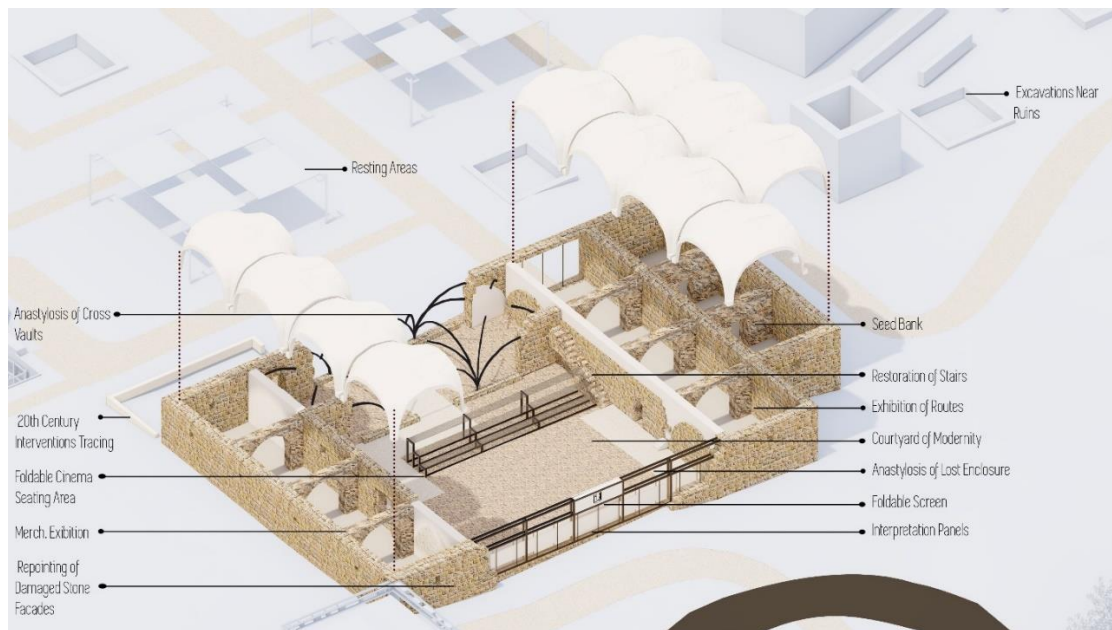


Figure 12. Proposed interventions for the Courthouse.



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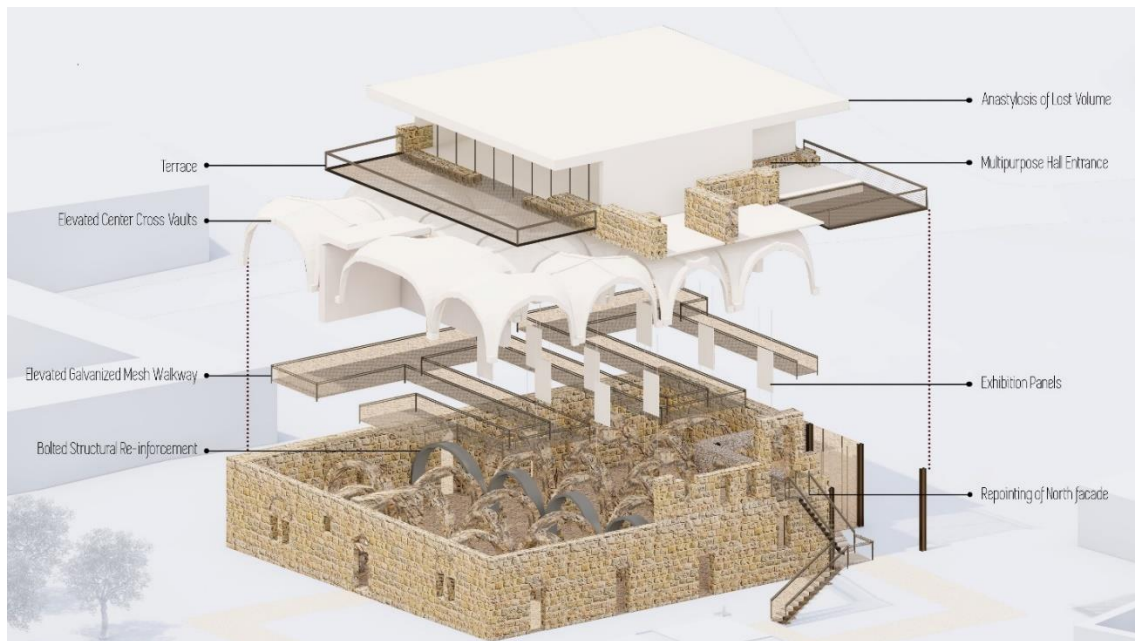


Figure 13. Proposed interventions for the Qasr.

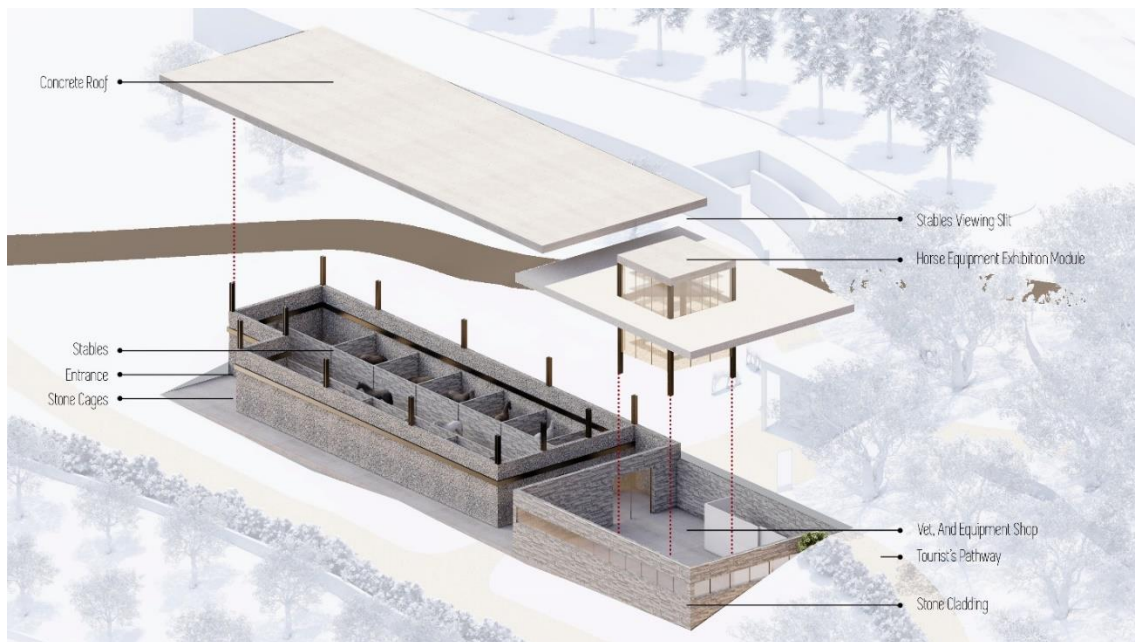


Figure 14. Proposed design of the community stables.



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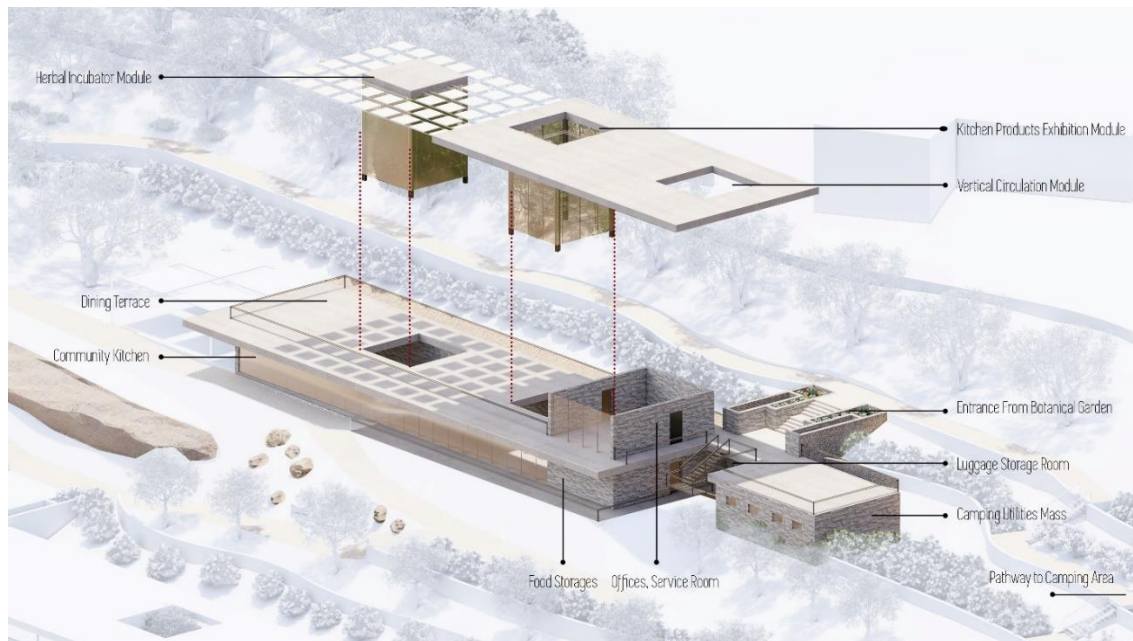


Figure 15. Proposed design of the community kitchen.

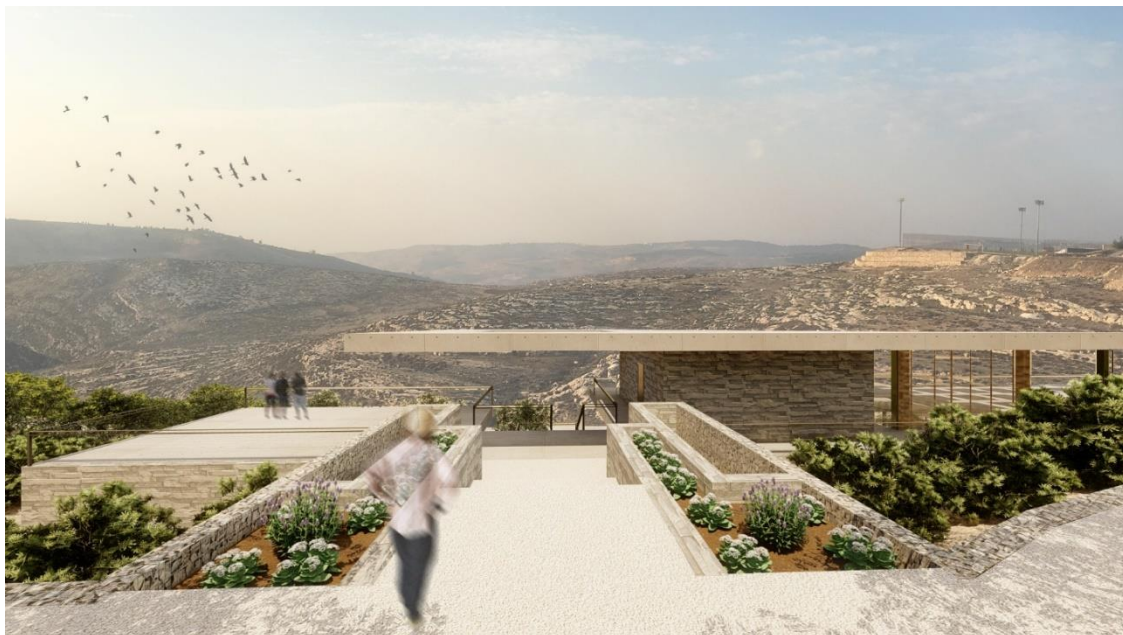


Figure 16. Proposed design of the community kitchen entrance.



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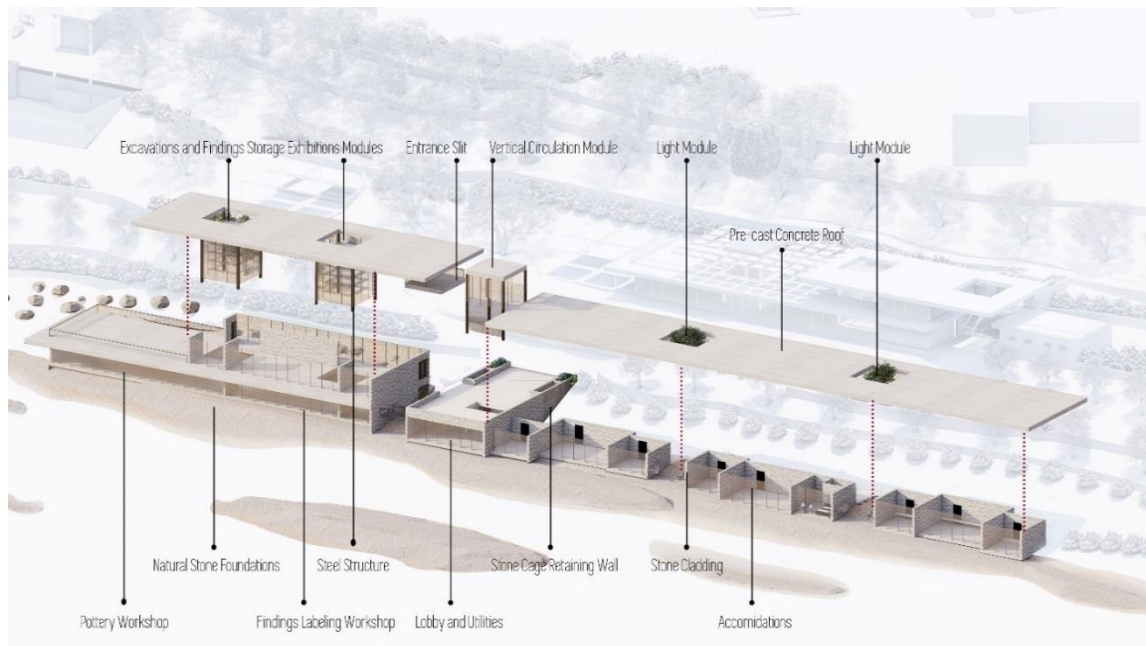


Figure 17. Proposed design of the dig-house and the accommodations.



Figure 18. Proposed design of the accommodations' hallway.

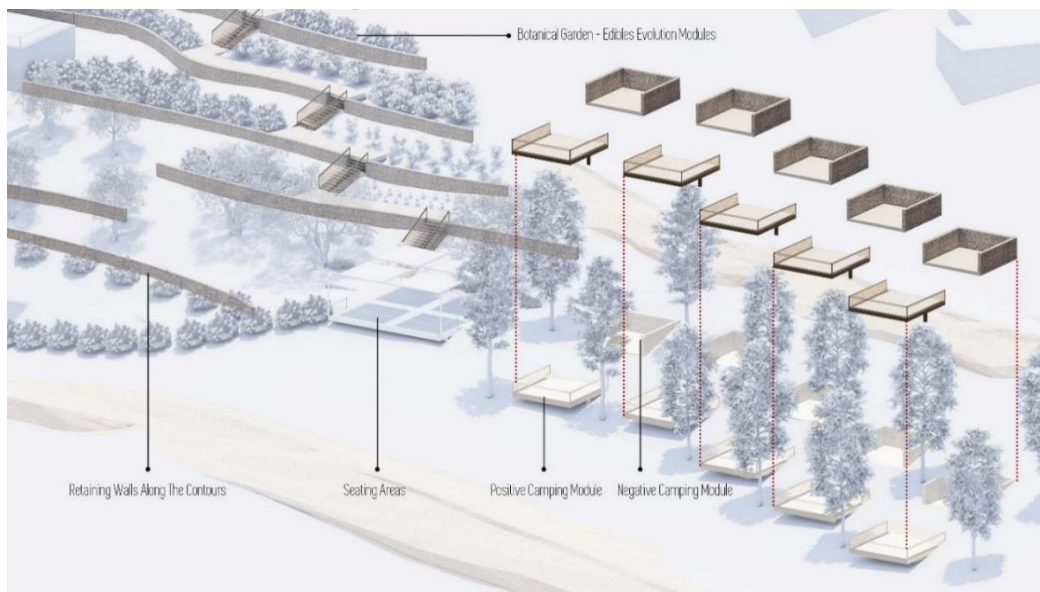


Figure 19. Proposed design of the camping area and the southern botanical garden.

Resource Analysis

-Capital cost:

The capital cost would be covered by a collaboration between the Department of Antiquities the Ministry of Tourism, and the Ministry of Agriculture, as the Municipality of Hisban would not be able to afford the potential costs of the project but can provide the workforce needed for the construction process.

-Running costs:

The vision included that the project would cover its own running cost by multiple revenue generating streams.

1-The ticketing

2-The accommodation

3-The restaurant

4-The stables

-Human Resources:

The project will have the capacity for providing new jobs, divided upon the staff of the accommodation units, restaurant and dining, tour guides, gardeners and horse keepers and the administrative parts. Whom will be employed from the local community.

Implementation Plan

The Project will be developed in 2 phases.

The first phase is the reuse part of the project. The second phase is the valley additions.



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The creation of the first phase of the project costs less than the second phase. This will enable the ticketing part of the project to open. Providing the revenue needed to build the second phase later. The first phase is fully functional and does not require the second phase to operate.

3.CONCLUSION

In the heart of Hisban, Jordan, a transformative endeavor has unfolded, aiming to breathe new life into the historical and cultural tapestry of this ancient village. As outlined in the abstract and introduction, the research presented here delves into the multi-faceted project that envisions Hisban as a thriving interpretation center and a hub for cultural exchange.

The journey embarked upon in this research has offered insights into the meticulous levels of intervention applied to rejuvenate a site bearing witness to over 3000 years of history. The visitor's center, the courthouse, the Qasr and the botanic garden, among other areas, have undergone extensive reimagining, from anastylosis efforts to structural support additions, all while respecting and preserving the historical significance of the site.

This project extends beyond physical restoration; it is an ode to community engagement, sustainability, and the preservation of cultural heritage. By involving local stakeholders and government bodies, the initiative not only ensures the sustainability of the center but also honors the heritage and memory of the land's previous occupants.

Moreover, the proposal exemplifies innovative design thinking, seamlessly integrating modern amenities with the natural landscape and historical structures. It fosters an enriching experience for visitors, offering a glimpse into the past while embracing the future.

In conclusion, the envisioned interpretation center in Hisban stands as a testament to the harmonious coexistence of heritage, community, and innovation. As this project progresses, it promises to serve as a beacon of cultural significance, educational enrichment, and economic revitalization, embodying the enduring spirit of Hisban and the enduring power of historical preservation. The journey undertaken in this research merely marks the beginning of a promising chapter in Hisban's storied history, as it continues to evolve and unfold, preserving the past while ushering in a vibrant future.

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**THE ROLE OF HUMAN CAPITAL AND TECHNOLOGY THROUGH
SUSTAINABLE DEVELOPMENT**

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ABSTRACT

In today's rapidly evolving world, a knowledge society and an innovative economy are emerging. Investing in human capital has become more critical than ever as we face the problems of the twenty-first century, including pandemics, automation, and climate change. To properly address these difficulties, individuals' abilities and knowledge are crucial. Additionally, putting money into human capital can help create societies that are adaptable to future changes in demand. As it aids in reducing inequality and poverty, investing in human capital can result in the growth of a society that is more inclusive and equitable. The amount of human money influences how quickly economies, technologies, and sciences advance. More innovations in the fields of manufacturing and other connected activities result from increased human capital. Growth is increased by innovation. Adopting new technology is also produced through human capital. But economic expansion and the rise of human capital also have an impact on technology. In a new phase of economic development known as the knowledge economy, knowledge plays a key role and serves as a source of growth. Last but not least, investing in human capital is essential for sustainable development, which includes long-term advantages for people, businesses, and society at large. An environment that is favorable for the growth of human capital can be created by governments, businesses, and individuals. To invest in people and create a better, more sustainable future, everyone works together.

Keywords: Human Capital, Economic Growth, Technology, Innovation, Knowledge Economy.

1. INTRODUCTION

Human capital has been a concept since the eighteenth century. In his book "An Inquiry into the Nature and Causes of the Wealth of Nations", which examined a nation's wealth, knowledge, training, abilities, and experiences, Adam Smith made reference to the idea. Adams argued that enhancing human capital through education and training results in a more successful business, increasing the overall wealth of society. Smith claims that make it a win for everybody. The core component of the country's wealth is managed by human capital in the economy. Therefore, all scholars agree that human capital—which is more potent than nature or wealth—is the most crucial resource of the community.

The COVID-19 pandemic is changing the way we work and spend, including with highly uneven impact across people. The increase in digitalization could increase productivity. Amid the need to reduce in-person interactions, the pandemic has propelled investment in intangibles,



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especially digital technologies, which has likely helped mitigate productivity losses stemming from measures to cope with the virus. The crisis can also affect the allocation of capital and labor across firms and sectors, with ambiguous effects on productivity. Skill gaps may present challenges. Some jobs vulnerable to automation or in contact-intensive activities may never come back, potentially triggering large job losses and requiring people to search for work in different sectors where new skills may be needed. Many people may face prolonged unemployment, eroding their skills and future productivity, and new entrants may face long-term lower earnings.

The development of the abilities required to support the operation and sustainability of an organization as well as to contribute to the welfare of societies and communities constitutes human capital, which is a crucial component of sustainability. Sustainability is not simply a check-the-box activity but rather a social, economic, and environmental factor that affects nearly every part of our existence. People are paying more attention to social concerns and sustainability now than ever before. Businesses are being compelled to take action and adhere to sustainability guidelines. A common transition framework for peace and prosperity for people and the earth, both now and in the future, is provided by the 2030 Agenda for Sustainable Development of the United Nations. The 17 interlinked Sustainable Development Goals (SDGs) - "the to-do list of the world" - are at the core of this agenda and aim to approach sustainable development holistically by targeting dignity, peace, and prosperity for the planet and humankind. In most countries, human capital determines the rate of development, economic, technological, and scientific progress. While providing stability for future generations and benefiting the entire world's population, sustainable development is not without difficulties. There are a large number of challenges that need to be met if we are to achieve a better future, like war and instability, suitability and availability, governmental issues, poverty & unemployment, population growth, and the global economy.

2. REVIEW of LITERATURE

Aqib, M., & Zaman, K. (2023), "Greening the Workforce: The Power of Investing in Human Capital", the role that human capital can play in accelerating economic growth is of interest to experts. Although some research has been done, more needs to be done on the topic of harnessing human capital to reduce carbon emissions in developing nations. Therefore, the study focused on how improving human capital can increase a nation's prosperity through enhancing environmental sustainability through labor-added technologies. By encouraging the development of cleaner industrial techniques, R&D spending and labor-augmented technology granger promotes life expectancy, which in turn helps improve the long-term viability of healthcare in a country. According to the conclusions of the innovation accounting matrix, during the next ten years, the two most important human capital determinants affecting carbon emissions will be life expectancy and the net enrolment rate. In addition to human capital, the green development agenda is also impacted by changes in the labour market, spending on research and development, and technology that makes work easier.

Natalya Guz and Margarita Kvashnina (2022) "Human capital and the knowledge economy as key challenges of post-industrial society", human capital, the foundation of both social and intellectual capital, is evolving from just being a factor in competitiveness to becoming the main source of social prosperity. The development of fundamentally altered economic relations and production relations against the backdrop of economic globalization is intimately related to changes in social and labour relations, particularly in employment models. The challenges



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associated with the formation and growth of human capital in the modern world stem from the fact that, on the one hand, people develop the most cutting-edge systems, including technology, technological knowledge, high-tech production methods, and market opportunities, which must be effectively and thoroughly managed.

Suryaning, Bawono. Eny Lestari, Widarni. (2021), "The Role of Technology in Human Capital and Economic Growth in Indonesia", both indirectly and directly influencing economic growth, technology plays a part in boosting the impact of human capital. But economic expansion and the rise of human capital also have an impact on technology. Economic expansion, technology, and human capital all have mutually beneficial effects.

3. OBJECTIVES of THE STUDY

1. To study about human capital and technology in sustainable development in global perspective.
2. To know the various roles of Human Capital and Technology in Driving Sustainable Development.
3. The impacts of technology in sustainable development
4. To study the various advantages and futures of technology in sustainable development.

Human Capital and Technology

Human capital is considered an organization's most important asset because, without humans, there will not be anyone to sell the company products or services, manage the company's daily operations, or handle customers effectively. Any organization will only be able to go as far as the people who are driving it. Human capital in the technology industry is a new form of human and social capital based on the accumulation of knowledge linked with the new information communications technologies. Modern economies and society are evolving in large part thanks to Information and Communication Technology (ICT). Human capital, creativity, and technology are the main propellers of a knowledge economy. This entails the creation and application of cutting-edge technology, the expansion of highly educated and skilled labour, and the encouragement of research and development with a focus on entrepreneurship and innovation.

Human capital, creativity, and technology are the main propellers of a knowledge economy. This entails the creation and application of cutting-edge technology, the expansion of highly educated and skilled personnel, and the encouragement of research and development with a focus on entrepreneurship and innovation. Because it fosters economic growth, social advancement, and environmental sustainability, human capital investment is a crucial component of sustainable development. By maximizing needed skills through employee recruitment, training, and development, human capital management (HCM) refers to workforce practices and resources. Administrative assistance, reporting and analytics, education and training, and hiring and recruitment are frequently handled by departments and software programmes with responsibility for human capital management.

Human Capital and Sustainability



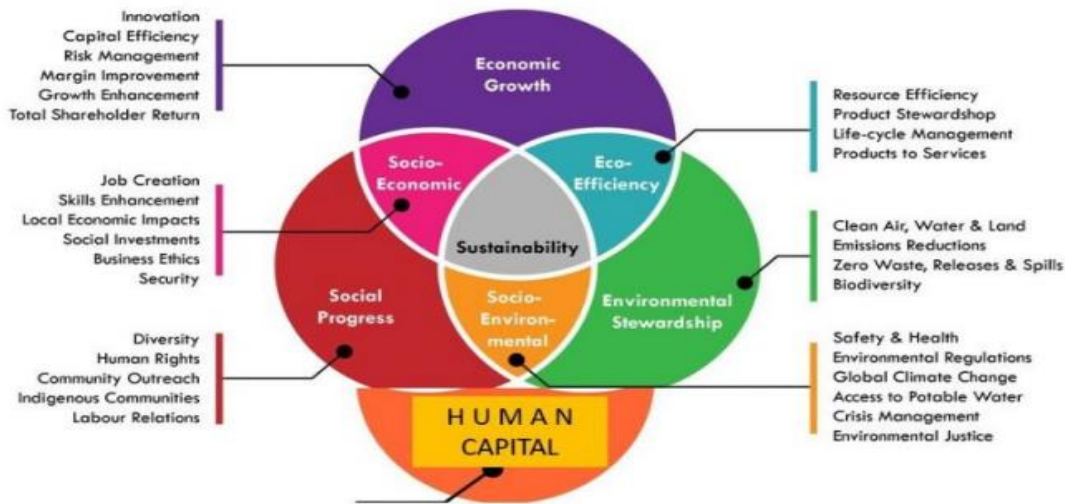
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The four pillars of sustainability are social, environmental, economic, and human. Human capital is integral to sustainability and involves the acquisition of the necessary skills to support the functioning and sustainability of an organization and to contribute to the well-being of societies and communities.

Figure 1. The four pillars of sustainability



Roles of Human Capital and Technology in Driving Sustainable Development

Human capital investment is an essential element of sustainable development, as it promotes economic growth, social advancement, and environmental sustainability.

Human Capital Development

Education and Skills: Investing in education and skills development enhances human capital. An educated and skilled workforce is more adaptable to technological changes and can contribute by driving innovation and productivity. **Healthcare:** Access to quality healthcare ensures a healthy workforce. Healthy individuals are more productive and can actively participate in economic activities, reducing the burden of healthcare costs on society.

Technology and Innovation

Environmental Sustainability: Technology can be harnessed to develop cleaner energy sources, reduce pollution, and mitigate climate change. For instance, renewable energy technologies like solar and wind power promote sustainability by reducing greenhouse gas emissions. **Efficiency and Productivity** Technological advancements improve production processes, reduce waste, and increase efficiency. This can lead to sustainable resource use and lower costs for businesses. **Access to Information:** Technology facilitates access to information, education, and markets. This inclusivity can empower marginalized communities, bridging economic disparities and promoting social sustainability.

Economic Growth

Innovation-Driven Growth: The synergy between human capital and technology drives innovation, which fuels economic growth. Sustainable economic development is characterized by diversification, reduced income inequality, and resilience against economic shocks. **Job Creation:** Technological advancements create new job opportunities, particularly in emerging



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sectors like renewable energy, biotechnology, and digital industries. These sectors often prioritize sustainability in their practices.

Global Connectivity

Knowledge Sharing: Technology facilitates global knowledge sharing, enabling countries to learn from each other sustainable development experiences. **Trade and Collaboration:** Technology connects global markets and fosters international collaboration on sustainability initiatives.

Monitoring and Evaluation

Data and Analytics: Technology provides tools for monitoring and evaluating sustainable development goals and initiatives. Data-driven insights help governments and organizations make informed decisions and track progress.

4.CONCLUSION

Human capital sustainability also requires ensuring that leadership is effective, that a company's human capital strategy is aligned with business strategy; that an organization has a healthy company culture, and that two key facets of human capital program design and delivery are preserving and creating value: Operational excellence, which focuses on achieving the optimal mix of people, processes, and technology. Talent experience focuses on how purpose, people, work, and total rewards combine with culture and leadership. Human capital development and technology are intertwined drivers of sustainable development. They empower individuals, businesses, and nations to address environmental, social, and economic challenges while fostering long-term prosperity and well-being for all. Human capital provides the knowledge, skills, and creativity to develop and implement sustainable solutions, while technology enhances productivity, enables innovation, and facilitates the monitoring and management impacts. Together, they drive progress toward a more sustainable and equitable future.

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DESIGNING THE EARTH'S WATER CYCLE MODEL: APPLICATIONS IN EDUCATION

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ABSTRACT

Designing a hydrological cycle model on Earth is the process of creating a simulation that replicates the water cycle stages, including evaporation, condensation, flow, and exchange within the natural environment. The model is constructed using various components, including the framework system, misting system, power supply unit, water pump motor, light bulbs, hot and cold reservoirs, cooling system, and other auxiliary components. An interactive model is designed to illustrate the phases and relationships among the water cycling processes in nature. Constructing a comprehensive model and designing teaching processes based on it has illustrated how water transitions through different states and interacts with the surrounding environment. Through interactive activities, students can observe how water impacts climate, topography, and ecosystems. Applying this practical model in an educational environment helps students understand the intricate process of water movement through different stages such as evaporation, condensation, and precipitation; enhance students' understanding of environmental science, hydrology, and the pivotal role of water within the Earth's ecosystem. Furthermore, educators leverage this model to employ a visual and interactive teaching approach to convey the significance of water conservation and sustainable practices. This method facilitates students' accessibility to complex scientific concepts.

Keywords: Hydrological Cycle Model, Water Cycling Processes, Climate, Evaporation, Condensation.

1. INTRODUCTION

Engineering science is the field of scientific disciplines related to the development of technology and the design of products, incorporating the application of natural scientific knowledge. Among these disciplines, the application of science and technology in engineering research is indispensable. The advancement of engineering science encompasses all creative and systematic activities that contribute to the development of knowledge related to both the natural and societal aspects of human life, ultimately leading to the creation of novel applications. This has been a continuous and overarching mission in the process of Vietnam's educational development, receiving significant attention and guidance from the government and the Ministry of Education and Training, particularly in the era of integration and Industry 4.0. Within educational institutions, research and the integration of scientific knowledge into teaching practices have also been of special concern during the fundamental and comprehensive educational reforms.



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The water cycle is the existence and movement of water on the Earth's surface, within the Earth, and in the Earth's atmosphere. Water on Earth is constantly in motion, transitioning from one state to another, from liquid to vapor and then to solid, and vice versa. The water cycle has been occurring for billions of years, and all life on Earth depends on it; Earth would undoubtedly be an uninhabitable place without water (*Anderson, Wilmouth, Smith & Sayres, 2012*).

The water cycle has no specific starting point, but we can begin with the oceans. The Sun drives the water cycle by heating the water in the oceans, causing it to evaporate into the atmosphere. The rising air carries water vapor into the atmosphere, where it encounters cooler temperatures, causing the water vapor to condense into clouds. Air currents transport these clouds around the globe, and cloud particles collide, combine, and grow, eventually falling to the ground as precipitation (rain). Precipitation in the form of snow accumulates as snowpacks and glaciers, which can store frozen water for thousands of years. In warmer climates, as spring arrives, snow melts and flows on the surface, sometimes leading to flooding. Most of the precipitation falls over the oceans or on land and, due to gravity, becomes surface runoff. Much of this surface runoff flows into rivers through river valleys in the region, with the main flow entering the oceans. Surface runoff, and some infiltrating water, collects and is stored in freshwater lakes. However, not all surface runoff flows into rivers; a significant amount of water infiltrates underground. Some of the infiltrating water is retained in the shallow subsurface and percolates back into surface water (and the oceans) as groundwater flow. Some groundwater flows out as freshwater springs. Shallow groundwater is absorbed by plant roots and then transpired through leaves (<https://vi.wikipedia.org/>).

According to Nguyễn (2005), water resources include the water in rivers, ponds, lakes, marshes, seas, oceans, as well as in the atmosphere and biosphere. In the Water Resources Law of the Socialist Republic of Vietnam, it is defined as, "Water resources include surface water, rainwater, groundwater, and seawater within the territory of the Socialist Republic of Vietnam." Water possesses two fundamental attributes: it can be beneficial, and it can be harmful. Water serves as the driving force for all economic activities of humans, but it can also pose unpredictable and significant threats to human life. Large floods, for instance, can cause casualties and, in extreme cases, can even destroy entire ecosystems.

A research document by author Nguyễn & Đặng, (2003) analyzed the relative proportions of various types of water on Earth. These proportions are depicted in Figure 2.

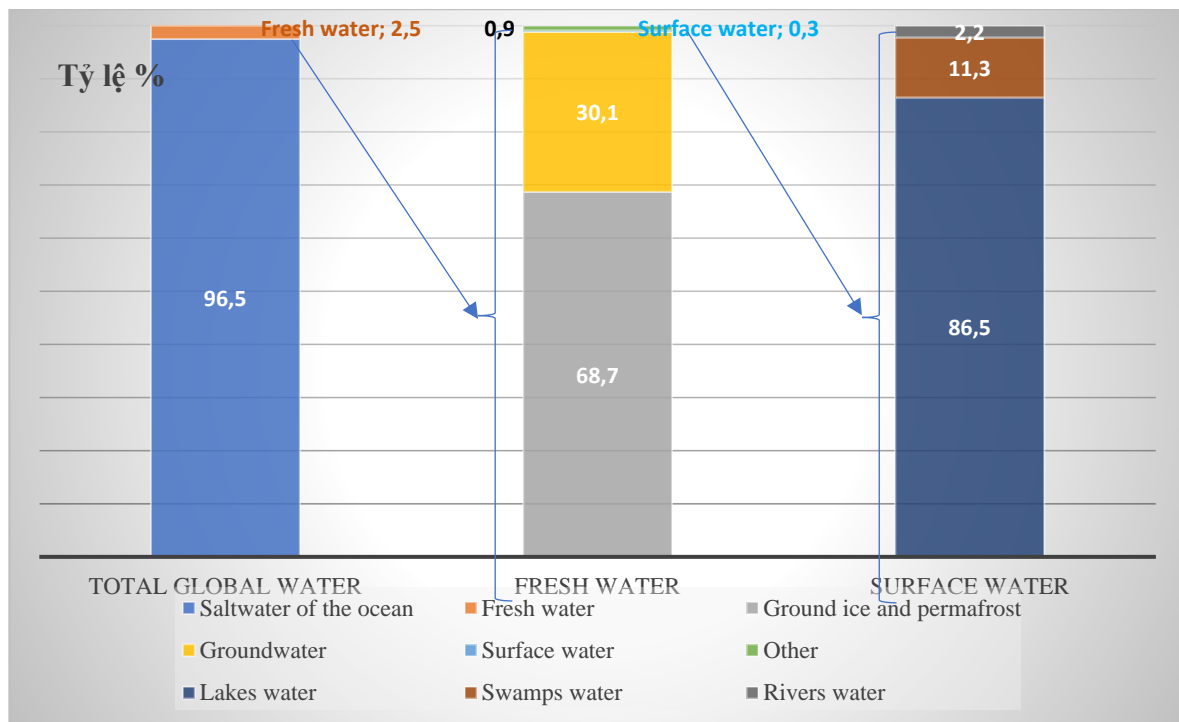


Figure 2. Water distribution ratio on Earth (Nguyễn & Dặng, 2003)

The studies focus on examining the role of water in society and the extent of its impact on the natural world and humanity. The majority of research designs serve production and business purposes. No studies on the application of the water cycle model in education have been found yet.

Research on the activities of the water cycle model on Earth

It is very difficult to accurately determine the exact amount of water on Earth, but through numerous surveys, calculations, and inferences, it is estimated that there is approximately 1.4 to 1.8 billion cubic kilometers (km³) of water on the planet. The water cycle is the existence and movement of water on the Earth's surface, within the Earth, and in the Earth's atmosphere. Water on Earth is constantly in motion, transitioning from one state to another, from liquid to vapor, and from solid to liquid and vice versa. The water cycle has been ongoing for billions of years, and all life on Earth depends on it; Earth would undoubtedly be an uninhabitable place without water (Nguyễn, Nguyễn, Nguyễn, & Nguyễn, 1991).

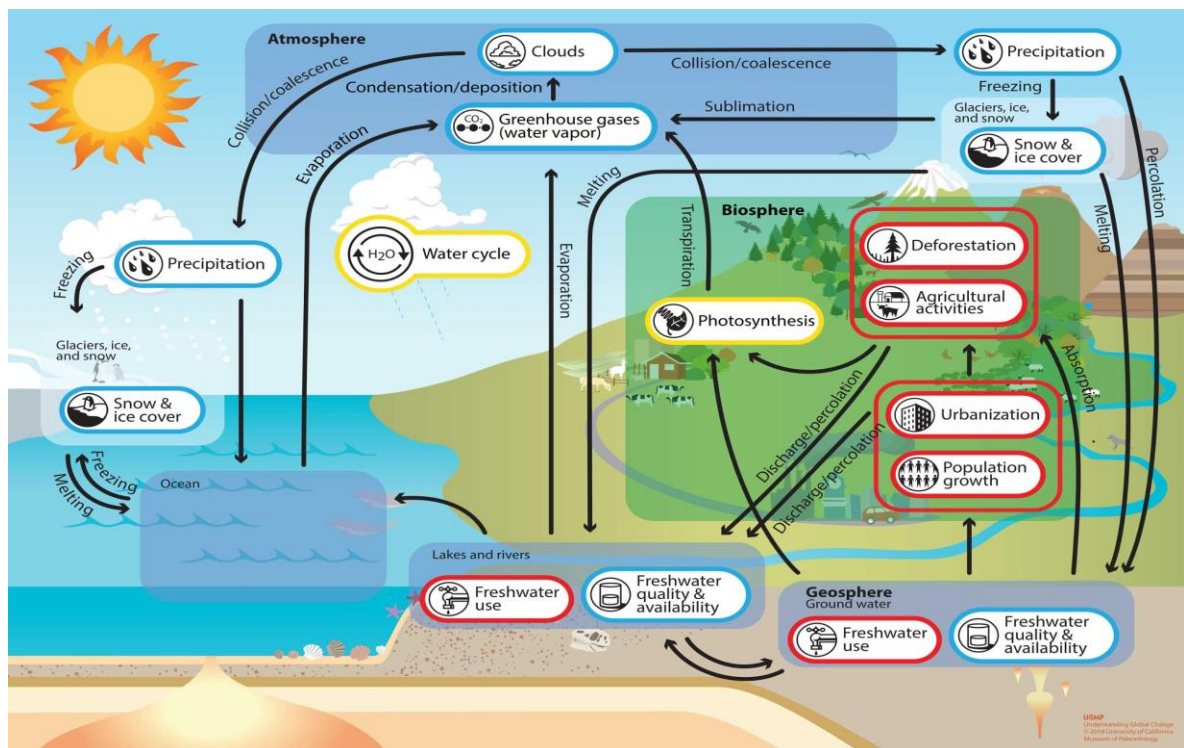


Figure 3. Earth system model of the water cycle (<https://ugc.berkeley.edu/background-content/water-cycle/>)

The water cycle model on Earth is simulated as shown in Figure 3. Therefore, water in reality exists in a closed cycle under the influence of natural conditions.

Research on teaching aids

The factors influencing the teaching process

There are three main factors that determine the quality of teaching: teachers, students, and teaching aids. These factors support each other as shown in the diagram below.

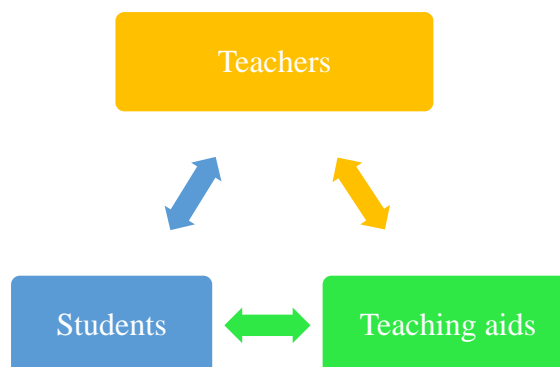


Figure 4. Correlation diagram between factors in teaching

Teaching aids are all the necessary material means for teachers and students to organize and conduct the educational process effectively and appropriately in various subjects and grade levels.



Teaching aids play an indispensable role in the teaching and learning process. The above factors interact and support each other. We can highlight some of the roles of teaching aids as follows:

- Is a teacher's working tool.
- Is a cognitive tool for students.
- Is the concretization of lesson content.
- Is the materialization of teaching methods.
- Contribute to promoting effective teaching and learning processes.

Thus, we can conclude that educational diversity is a factor closely linked to the pedagogical process, a measure reflecting the advancement and modernity of the learning environment in schools.

2. MATERIALS and METHODS

Designing a model of the water cycle on Earth and conducting experiments in teaching 10th-grade Geography aims to enhance students' comprehension of the lessons and generate enthusiasm during class. After designing the model, experiments were conducted, and the effectiveness of applying the model in teaching was evaluated.

During the research process, the author's team utilized various research methods, including: Theoretical research method; Modeling method; Empirical research method; Statistical analysis method.

3. FINDINGS and DISCUSSION

Design a water cycle model on Earth

The design diagram simulating the Earth's water cycle ensures all the natural elements are present to create a realistic model, making it easier for students to visualize in reality. Based on the diagram in Figure 3, prepare the appropriate materials for assembling a water cycle system in nature into a suitable model for the classroom.

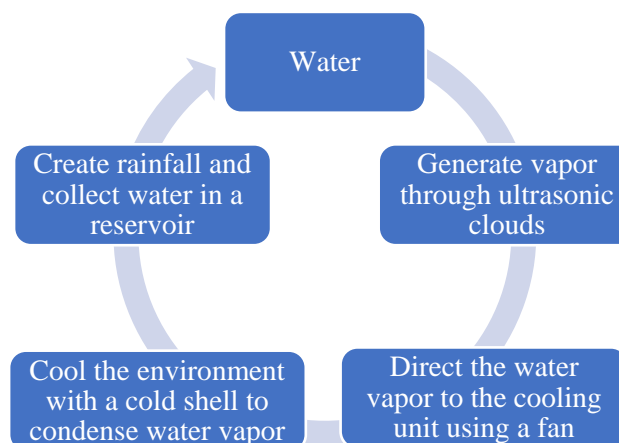


Figure 5. Rules of the water cycle in the model

When providing power to the system, the ultrasonic head immediately acts on the surrounding water, creating water vapor. The rising water vapor is directed into the chip peltier system to



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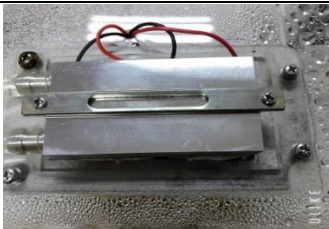


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undergo the condensation process. The cooled condensed water forms rainfall and is then collected in a reservoir, completing a water cycle.

Prepare equipment and tools

Prepare some equipment and tools as described in the table 1.

Table 1. Information and images of the components of the "Model" design

Component name	Purpose of use	Illustrating images
Physical model of rivers and mountains	Simulates mountains and rivers	
Mist generation system (Ultrasonic generator)	Creates mist to form rain	
Ultrasound power supply	Convert AC-220V voltage to DC-48V	
Power supply	Convert AC-220V voltage to DC-12V to supply fans, pumps, and coolers	
Light bulb	Symbolizes the Sun	



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Chip peltier

Condense water vapor



Mica frame shell system

Observe clearly inside



Mini pump

Use for pumping water



Flexible plastic tubes with a diameter of Ø8

Used for water conveyance



Mini fan

Used for suction of water vapor



Operation Principles of the Devices:

Mist Generation System (Ultrasonic Transducer): When power is supplied, the current directed to the transducer head is converted into high-frequency alternating current, which then emits ultrasonic waves through the humidifying orifice. Water in contact with the ultrasonic waves is atomized into a mist. This component is placed in a water reservoir.

Mini fan: The rising water vapor is directed by the fan to the cooling unit, which consists of two hot-cold modules and a metal heat-conducting block (we chose aluminum due to its cost-effectiveness and efficient heat conduction).



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Chip peltier: The hot-cold module has two sides; when power is supplied, one side cools while the other side heats up. The cold side is fixed with an aluminum block for cooling and condensing water vapor. On the hot side, a water circulation system is used to cool the hot side by transferring water from the reservoir, preventing component damage.

The steps for designing a model

Step 1: Design the Mica frame

- Cut mica to size appropriate to the design table.
 - + 6 large mica panels for the box.
 - + Smaller panels are used to divide the box into multiple parts for each cycle, keeping components in different positions convenient for operation.
- Use glue to permanently attach the large mica panels to form the box.
- Attach smaller mica panels to partition each component and process.

Step 2: Install and fix the devices in the required position

- Mist generation system: Placed at the water tank, the lowest position of the system to stimulate the steam generation process.
- Mini fan: on the top floor, helps bring steam to the condensation area.
- Cooling area: Attach the cold side of the cooler to the metal block for heat dissipation and ease of installation. The hot side is attached to a cooling system that includes a water pump and a housing.
- Light bulb: Mounted on the wall of the system, representing the sun.

Step 3: Power up the devices

- Use 2 sources located at the lowest position of the system.
 - + Honeycomb source is used to lower the voltage from AC 220V to DC 48V for the ultrasound head.
 - + Source 2 reduces the voltage to DC 12V for cooling, fans, and pumps.

Step 4: Complete the product



Figure 6. Front and back view of the model



Figure 7. The left and right sides of the model



Figure 8. The model while it is operating

Operating instructions

Step 1: Supply water to the device

Open the button on the top of the device, add water (normal filtered water) until it reaches the blue line on the device wall (or completely submerges the ultrasound head (Figure 6)).

Step 2: Power the device

Plug the device's power plug into the 220V source, turn the power button to ON

Step 3: Create clouds

Turn the ultrasonic steam generation button to ON,

Step 4: Create wind (air convection)

Turn on the fan button to create convection air towards ON.

Step 5: Observe the phenomenon.

Teachers and students can observe the natural water cycle phenomenon modeled in the device "Designing the Earth's Water Cycle Model: Applications in Education". Water on Earth under the influence of nature evaporates, is carried by the wind, condenses to form clouds, and meets cold air in the atmosphere to form rain... (Figure 3).



Experimental investigation of the model

We conducted product model testing on students from two high schools, with a total of 320 students participating in the experimental learning on the model. We had the students operate the model and observe the phenomena, and then we distributed survey questionnaires to assess the results.

Table 2. Situation of students participating in learning with the model

Survey subjects	Students' comments				Percentage of students who enjoy learning through the model	
	Have learned		Never studied		Total	
	Number of students	%	Number of students	%		
Class 10/1	2	4,76	40	95,24	97,62	42
10/2	3	6,98	40	93,02	97,67	43
10/3	7	17,50	33	82,50	97,50	40
10/4	10	24,39	31	75,61	95,12	41
10A3	4	19,05	17	80,95	95,24	21
10A4	6	26,09	17	73,91	100,00	23
10A5	2	12,50	14	87,50	93,75	16
10B1	0	0,00	33	100,00	100,00	33
10B2	4	13,79	25	86,21	100,00	29
10D1	2	6,25	30	93,75	100,00	32
Total	40	12,50	280	87,50	97,81	320

With a total of 320 students questioned, 313 students, accounting for 97.81%, wanted to study in combination with the model. This shows that there needs to be improvements in education to ensure the needs of learners. Learning theory combined with visual models helps students easily understand the lesson, remember it for a long time and understand the issues in the teacher's lecture content.

The level of response of the model in learning is shown in Figure 9.

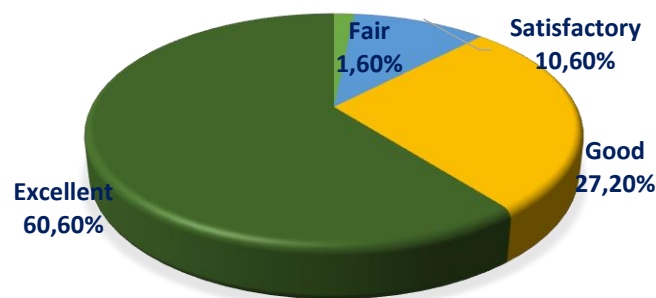




Figure 9. The level of response of the model in learning

The favorable and very favorable opinions account for 87.8%, which is a relatively high proportion. At the same time, there are many opinions that the "Model" has many advantages such as: it feels very enjoyable, clearly illustrates phenomena, accurately reflects reality, is vivid, useful, enhances students' interest, makes knowledge easier to remember, and encourages creativity... Teachers and students highly appreciate both scientificity, creativity, pedagogy and aesthetics, practicality and effectiveness.

4. CONCLUSION and RECOMMENDATIONS

The project "Designing the Earth's Water Cycle Model: Applications in Education" has provided students and teachers with a visual tool for teaching and learning. The research results, which were tested, have shown a high effectiveness rate, with 97.81% of students expressing a strong liking for learning with this model. The authors also developed a set of multiple-choice questions to evaluate students' knowledge after experimenting with the model, the results are shown in Figure 10.

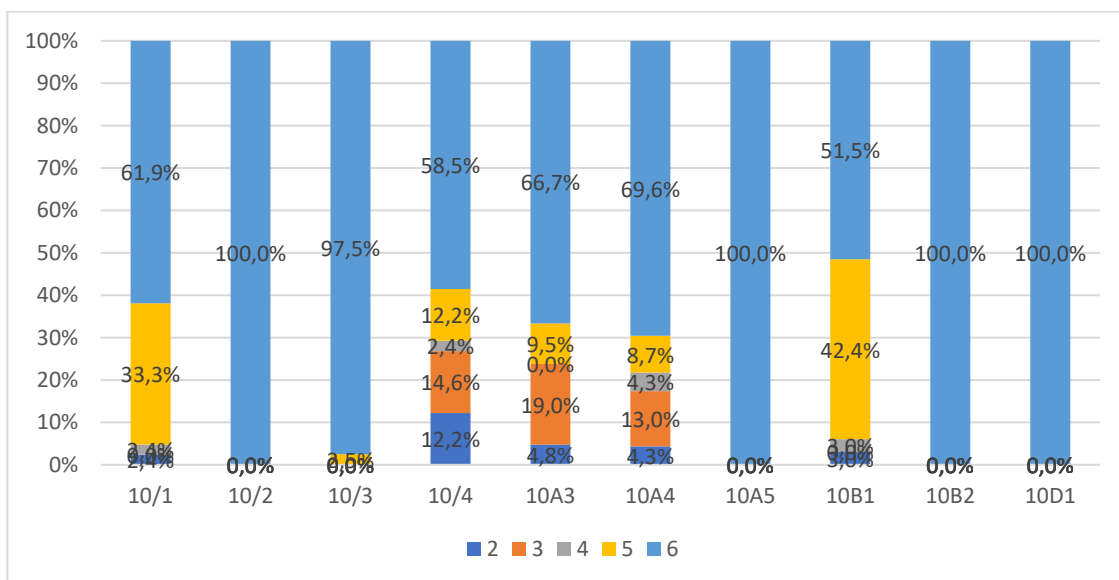


Figure 10. Learning outcomes for Geography lessons using models

The set of questions includes 6 questions moderated by the teacher in charge of the class, each question corresponds to 1 point. The results showed that 256/320 students answered all 6 questions correctly, accounting for 80.0%.

There are 4 classes 10/2, 10A5, 10B2 and 10D1 with 100% of students answering all 6 questions correctly, while class 10B1 has 51.5% of students answering 6 questions. 12.2% of 10th/4th grade students answered 2 questions. Thus, classes 10/4 and 10A3, 10A4 and 10B1 have the highest percentage of students answering incorrectly among the 10 classes, among them there are students who can only answer 3/6 questions and 2/6 questions.

With the research results obtained, we affirm that the project "Designing the Earth's Water Cycle Model: Applications in Education" has yielded very positive outcomes in supporting teaching activities in secondary schools. The research involved a comprehensive analysis of the theoretical foundation of the water cycle on Earth to better understand its principles. The



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model's design accurately represents these principles, ensuring that the natural water cycle occurs as it should.

In particular, we conducted experiments with 320 students in Vietnam. Based on these results, we recommend that educational institutions consider the following when using the learning model:

- Utilize teaching materials that align closely with the curriculum content.
- Ensure that educational equipment and materials are integrated with textbook content.
- Adapt to the specific characteristics of each subject.
- Serve the purpose and requirements effectively, at the right time and place.
- Homemade teaching materials should be cost-effective while maintaining precision, scientific accuracy, and aesthetic appeal.

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RESPONSE IN MITIGATING ENVIRONMENTAL DAMAGE AND MIS-MANAGEMENT CAUSED FROM EMERGENCIES AND DISASTERS.

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ABSTRACT

Preparedness in disaster response is a crucial aspect that cannot be overlooked. It involves the measures taken to mitigate the impact of disasters and ensure that communities are equipped to handle emergencies. Preparedness is essential because it enables individuals, organizations, and governments to respond effectively to disasters, save lives, and minimize damage. One of the key aspects of preparedness in disaster response is education. Communities need to be educated on how to prepare for disasters, what actions to take during an emergency, and how to respond after a disaster has occurred. This includes having emergency kits with essential supplies such as food, water, first aid kits, flashlights, and batteries. In addition to this, governments must have contingency plans in place for various types of disasters such as earthquakes or hurricanes. These plans should include evacuation routes for affected communities as well as shelters where people can seek refuge. Preparedness in disaster response is critical for saving lives and minimizing damage caused by natural calamities or other emergencies. It involves educating communities on how best to prepare for disasters; establishing effective communication channels; training personnel who can respond effectively during an emergency; and having contingency plans in place at all times. By taking these measures seriously the impact of disasters can be reduced on our communities while ensuring that people are better equipped to handle future emergencies when they arise. Emergencies and disasters can strike at any time and without warning. It is important to be prepared for such situations to ensure the safety of oneself, family, and community. This includes knowing evacuation routes, meeting places for family members, and having emergency contacts readily available. Being prepared for emergencies and disasters not only ensures personal safety but also helps communities recover more quickly from these events. It is recommended that, when individuals take responsibility for their own safety, they are less likely to require assistance from emergency services which frees up resources for those who truly need them.

Keywords: Mitigating, Environmental, Emergencies and Disasters.



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1. INTRODUCTION

Preparedness in disaster response is a crucial aspect that cannot be overlooked. It involves the measures taken to mitigate the impact of disasters and ensure that communities are equipped to handle emergencies. Preparedness is essential because it enables individuals, organizations, and governments to respond effectively to disasters, save lives, and minimize damage. One of the key aspects of preparedness in disaster response is education. Communities need to be educated on how to prepare for disasters, what actions to take during an emergency, and how to respond after a disaster has occurred. This includes having emergency kits with essential supplies such as food, water, first aid kits, flashlights, and batteries. Another important aspect of preparedness is communication.

During a disaster or emergency situation, communication channels must be established so that people can receive timely information about what is happening and what actions they need to take. This includes setting up warning systems such as sirens or text alerts. Preparedness also involves having trained personnel who can respond effectively during an emergency. This includes firefighters, police officers, medical personnel, and search and rescue teams among others. These individuals must have the necessary skills and equipment needed for their roles. In addition to this, governments must have contingency plans in place for various types of disasters such as earthquakes or hurricanes. These plans should include evacuation routes for affected communities as well as shelters where people can seek refuge. Preparedness in disaster response is critical for saving lives and minimizing damage caused by natural calamities or other emergencies. It involves educating communities on how best to prepare for disasters; establishing effective communication channels; training personnel who can respond effectively during an emergency; and having contingency plans in place at all times. By taking these measures seriously we can reduce the impact of disasters on our communities while ensuring that we are better equipped to handle future emergencies when they arise.

Steps to Take to Prepare for Emergencies and Disasters

Emergencies and disasters can strike at any time, leaving individuals and communities in a state of chaos and confusion. It is essential to take steps to prepare for such events to minimize the impact they have on our lives. Here are some crucial steps that everyone should take to prepare for emergencies and disasters.

Firstly, it is important to create an emergency plan. This plan should include details about evacuation routes, meeting places, emergency contacts, and important documents that need to be kept safe. The plan should be discussed with all family members so that everyone knows what to do in case of an emergency.

Secondly, it is important to stock up on essential supplies. This includes food, water, first aid kits, flashlights with extra batteries, blankets, and other necessary items. It is also important to keep a supply of any medications that family members may need.

Thirdly, it is crucial to stay informed about potential emergencies or disasters in your area. This can be done by signing up for alerts from local authorities or downloading relevant apps on your phone.

Fourthly, it is important to practice emergency drills regularly with family members or co-workers if you work in a shared space. This will help ensure that everyone knows what they need to do in case of an actual emergency.

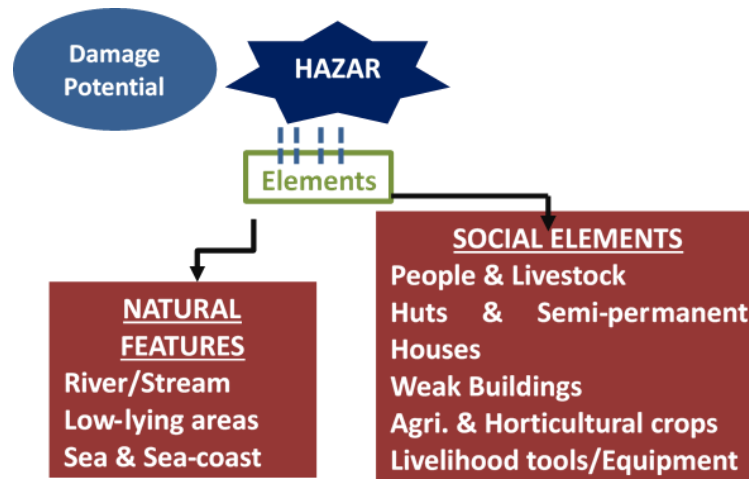


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Lastly, it is essential to have insurance coverage for emergencies or disasters such as floods or fires. This will help cover the costs associated with repairing damages caused by these events.



Importance of Being Prepared for Emergencies and Disasters

Emergencies and disasters can strike at any time and without warning. It is important to be prepared for such situations to ensure the safety of oneself, family, and community. Being prepared for emergencies and disasters means having a plan in place, adequate supplies, and knowledge of what to do in different scenarios. Having a plan in place is crucial when it comes to emergencies and disasters. This includes knowing evacuation routes, meeting places for family members, and having emergency contacts readily available. It is also important to have a communication plan in place so that everyone knows how to stay in touch during an emergency. Adequate supplies are also necessary when it comes to being prepared for emergencies and disasters.

This includes having enough food, water, medication, first aid supplies, and other essentials on hand. It is also important to have backup power sources such as generators or solar panels in case of power outages. Knowledge of what to do during different scenarios can make all the difference during an emergency or disaster. Knowing how to perform CPR or basic first aid can save lives while knowing how to shut off gas or water lines can prevent further damage from occurring. Being prepared for emergencies and disasters not only ensures personal safety but also helps communities recover more quickly from these events. When individuals take responsibility for their own safety, they are less likely to require assistance from emergency services which frees up resources for those who truly need them. In conclusion, being prepared for emergencies and disasters is essential for personal safety as well as the well-being of communities as a whole. By having a plan in place, adequate supplies on hand, and knowledge of what to do during different scenarios individuals can help mitigate the effects of these events on themselves and others around them.

Role of First Responders in Emergency and Disaster Response

First responders play a critical role in emergency and disaster response. These individuals are the first to arrive at the scene of an emergency or disaster, and their quick actions can often mean the difference between life and death for those affected. The role of first responders begins with preparation. They must be trained to respond quickly and effectively to a wide range of emergencies, from natural disasters like hurricanes and earthquakes to man-made incidents



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such as terrorist attacks or industrial accidents. This training includes learning how to assess the situation, provide medical assistance, evacuate people safely, and communicate with other emergency personnel. During an emergency or disaster, first responders are responsible for providing immediate assistance to those in need. This may involve administering first aid or CPR, stabilizing patients for transport to a hospital, or rescuing people trapped in dangerous situations. They must also work quickly to evacuate people from affected areas and ensure that everyone is accounted for. In addition to providing immediate assistance, first responders also play a critical role in coordinating the overall response effort. They work closely with other emergency personnel such as police officers, firefighters, and paramedics to ensure that resources are deployed effectively and efficiently. This may involve setting up command centers or coordinating transportation for evacuees. One of the most important aspects of the role of first responders is communication. They must be able to communicate effectively with each other as well as with members of the public who may be affected by the emergency or disaster. This includes providing clear instructions on what actions people should take (such as evacuation orders) as well as keeping everyone informed about developments in the situation.

Finally, first responders also play an important role in recovery efforts following an emergency or disaster. They may assist with search-and-rescue operations or help provide basic necessities like food and water for those affected by the event. They may also work closely with local officials and community organizations to help rebuild damaged infrastructure or provide support services for those who have been displaced. In conclusion, the role of first responders in emergency and disaster response is critical. These individuals are responsible for providing immediate assistance to those in need, coordinating the overall response effort, communicating effectively with other emergency personnel and members of the public, and assisting with recovery efforts. Their quick actions and dedication can make all the difference in saving lives and minimizing the impact of an emergency or disaster.



Importance of Quick Response in Mitigating Damage from Emergencies and Disasters

Emergencies and disasters can strike at any time, leaving behind a trail of destruction and chaos. In such situations, quick response is crucial in mitigating the damage caused by these events. The importance of quick response cannot be overstated as it can make all the difference between life and death. One of the primary reasons why quick response is essential in emergencies and

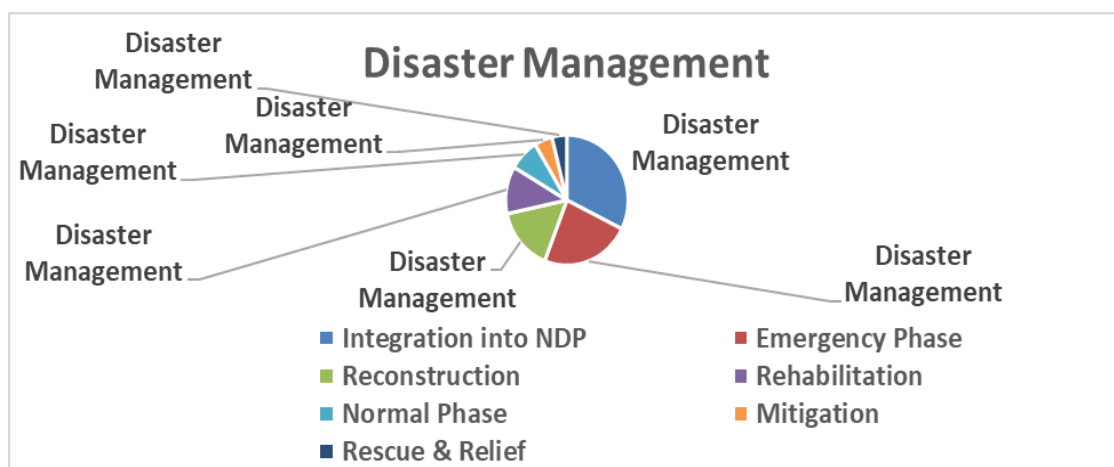


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disasters is that it helps to save lives. When an emergency occurs, every second counts, and a delay in response can result in loss of life. For instance, during natural disasters such as earthquakes or floods, people may get trapped under debris or floodwaters. Quick response teams with specialized equipment can help rescue these individuals before it's too late. Another reason why quick response is vital in emergencies and disasters is that it helps to minimize property damage. Fires are one of the most common emergencies that occur worldwide, causing significant property damage each year. However, if firefighters respond quickly to a fire outbreak, they can prevent the fire from spreading further and causing more damage. Quick response also helps to reduce economic losses resulting from emergencies and disasters.



Disasters often disrupt economic activities leading to losses for businesses and individuals alike. However, if emergency responders act quickly to contain the situation, they can minimize economic losses by restoring normalcy as soon as possible. Moreover, quick response helps to restore order after an emergency or disaster has occurred. In many cases, emergencies lead to chaos as people try to flee or seek help. However, if there are trained responders on hand who know how to handle such situations efficiently, they can restore order quickly. In conclusion, quick response plays a critical role in mitigating damage from emergencies and disasters. It saves lives by providing timely assistance when needed most; minimizes property damage by preventing fires from spreading further; reduces economic losses resulting from disruptions caused by disasters; restores order after an emergency has occurred so that people can resume their daily activities without fear or anxiety. Therefore, it is essential to have well-trained and equipped emergency response teams in place to respond quickly to emergencies and disaster.

Significance of Emergency and Disaster Response

Emergency and disaster response is an essential aspect of any community's safety and security. The ability to respond quickly and effectively to emergencies can mean the difference between life and death, as well as minimize damage to property and infrastructure. In this essay, we will recap the importance of emergency and disaster response. Firstly, emergency response teams play a crucial role in saving lives during natural disasters such as hurricanes, earthquakes, floods, or wildfires. These teams are trained to provide immediate assistance to those in need by providing medical aid, shelter, food, water, and other essential supplies. Secondly, emergency response plans help communities prepare for potential disasters before they happen. By having a plan in place that outlines procedures for evacuation routes or communication



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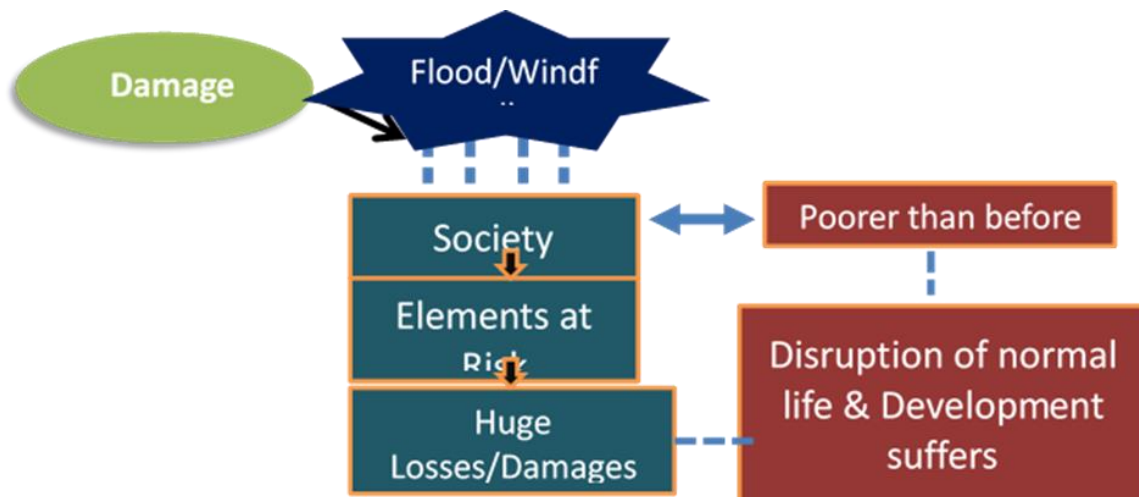
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protocols between first responders and government officials can save countless lives. Thirdly, disaster response efforts can help mitigate the long-term effects of natural disasters on communities. For example, rebuilding efforts after a hurricane or earthquake can help restore infrastructure that was damaged during the event. Lastly but not least important is that effective emergency response efforts require collaboration between various agencies such as law enforcement agencies or fire departments. By working together towards a common goal of protecting citizens' safety during emergencies or disasters can ensure better outcomes for all involved parties. In conclusion, emergency and disaster response is an integral part of any community's safety plan. It is crucial to have well-trained first responders who are equipped with the necessary tools to respond quickly when needed. Moreover, having a comprehensive plan in place ensures that everyone knows what their role is during an emergency situation which ultimately saves lives.

Challenges of Emergencies and Disasters

The aftermath of such events can be overwhelming, both for the affected individuals and the government agencies tasked with responding to them. In this study, various challenges would be explored that arise in the aftermath of emergencies and disasters. One of the most pressing issues in the aftermath of an emergency or disaster is providing immediate relief to those affected. This includes providing shelter, food, water, medical care, and other essential supplies. The government agencies responsible for responding to these events must work quickly to assess the situation and provide assistance as soon as possible.



Another major challenge is restoring infrastructure and basic services such as electricity, water supply, telecommunications, transportation networks etc. These services are critical for people's survival and recovery from disasters. Rebuilding damaged infrastructure requires significant resources which may not be readily available especially in developing countries. The psychological impact of emergencies and disasters cannot be overlooked either. Survivors may experience trauma or PTSD which can have long-lasting effects on their mental health if not addressed properly. Therefore, it is important that mental health support is provided alongside physical support. In addition to these challenges there are also issues related to economic recovery after a disaster strikes. Businesses may suffer losses due to damage caused by natural calamities leading to job losses for employees which further impacts local economies.



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Action forward

Emergencies and disasters can strike at any time, without warning. They can be natural disasters such as hurricanes, earthquakes, or floods, or man-made disasters such as terrorist attacks or industrial accidents. In any case, being prepared for emergencies and disasters is crucial to ensure the safety of individuals and their families. The first step in being prepared for emergencies and disasters is to have a plan. This plan should include an emergency contact list with names and phone numbers of family members, friends, and emergency services. It should also include a meeting place in case family members are separated during the disaster. Another important aspect of being prepared is having an emergency kit ready. This kit should contain essential items such as water, non-perishable food items, first aid supplies, flashlights with extra batteries, blankets, and a radio. It is also important to have a supply of any necessary medications on hand. In addition to having a plan and an emergency kit ready, it is important to stay informed about potential emergencies or disasters in your area. This can be done by signing up for local alerts through text messages or email notifications from local authorities. It is also important for individuals to take steps to protect their homes from potential damage during emergencies or disasters. This may include securing loose objects outside the home that could become projectiles during high winds or installing shutters on windows to protect against flying debris. Being prepared for emergencies and disasters not only ensures the safety of individuals but also helps reduce the burden on emergency services during times of crisis. By taking steps ahead of time to prepare for potential emergencies or disasters, individuals can help minimize the impact these events have on themselves and their communities. It is imperative that individuals take responsibility for their own safety by preparing themselves for potential emergencies and disasters. By having a plan in place, an emergency kit ready at all times, staying informed about potential threats in their area and taking steps to protect their homes, individuals can help ensure their safety and the safety of their loved ones. It is important to remember that emergencies and disasters can happen at any time, so being prepared is not only a good idea but also a necessity.

2. CONCLUSION

In conclusion, emergencies and disasters have far-reaching consequences that require a coordinated response from all stakeholders involved including governments at all levels (Local, State, Federal), non-governmental organizations (NGOs), international organizations like UN etc. It is essential that we learn from past experiences so that we can better prepare ourselves for future emergencies or disasters.

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**THE PHOSPHATE OF MOROCCO: PALEO GEOGRAPHY OF THE
MAASTRICHTIAN OF THE WESTERN HIGH ATLAS**

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ABSTRACT

*The investigation of the Maastrichtian epoch in the Western High Atlas region reveals insights across biostratigraphy, lithostratigraphy, and paleogeography. The study emphasizes Echinoderm and ostracod identification. Notably, ostracods include (*Bythocypris gohrbandti* "Wesker 1968", *Ovocytheridea cf. producta*, *Cytherellia aff. gambiensis* "Apostolescu 1963", and *Paracyris* sp.), while the Echinoderm assemblage features *Petalobrissus subsetifensis* (Péron and Gauthier), indicative of the Maastrichtian. The correlation of Maastrichtian deposition sequences with third-order eustatic cycles confirms eustatic dominance in sedimentation. Nevertheless, tectonic activity was noted at the beginning of the Maastrichtian, causing abrupt variations in thicknesses associated with local subsidence and uplift. Synsedimentary faults and angular unconformities at the base of the Maastrichtian also indicate tectonic activity. Paleogeographically, the Maastrichtian marks an Atlantic transgression, resulting in the Erguita Basin being isolated from the phosphorus-rich Atlantic during the Campanian, while maintaining connectivity with the Imin'Tanout Basin through the Argana Corridor. In this work, we propose the hypothesis of openings in the Souss Basin to the*



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Atlantic as a phosphorus source. The phosphate series demonstrates rhythmic sedimentation alternating between carbonate and phosphate-rich strata with organic residues. This reflects phosphatogenesis, associated with intense benthic activity in warm, shallow, well-ventilated environments. The end of the Maastrichtian shows a widespread regional discontinuity, witnessed beyond Morocco. This marks a global mass extinction concurrent with Late Cretaceous regression linked to the opening of the North Atlantic.

Keywords: Phosphate, Paleogeography, Maastrichtian, High Atlas, Morocco.

I. INTRODUCTION

Phosphates are highly coveted due to their phosphorus (P) content, a fundamental chemical element denoted as P in the realm of chemistry. Phosphorus serves as an indispensable constituent within the cellular structures of organisms, particularly humans. It plays a pivotal role in the construction of nucleic acids, namely DNA and RNA, as well as numerous enzymes (Corbridge, 2016). Its significance extends to the vital functions of energy storage and transfer within cells (Föllmi, 1996; Filippelli, 2011; Corbridge, 2016). In the animal kingdom, phosphorus manifests in the composition of bones and teeth, while in the plant domain, it assumes responsibility for the transmission of energy harnessed through photosynthesis.

Phosphorus, as an inherent substance, pervades our environment ubiquitously. Its presence is encountered daily, from the toothpaste employed in morning routines to the constituents of various food items (dairy, eggs, meats, fish, vegetables, and dried fruits). It forms the foundation of select pharmaceutical products and finds applications in diverse domains, including animal nutrition, detergent production, food preservation, and various other industrial pursuits.

Mineral phosphates assume paramount significance primarily in the realm of soil fertilization. These compounds serve as crucial fertilizers, with a substantial majority (85%) of global production devoted to enhancing soil fertility.

In the right proportions, phosphorus fosters root development in plants, augments their nutritional uptake, and enhances their resilience against diseases. These virtues culminate in augmented crop yields, both quantitatively and qualitatively, underscoring the indispensable role of phosphorus in agricultural productivity and, by extension, human nutrition.

Phosphorus extraction can be sourced from three distinct categories of phosphate deposits:

1. **Magmatic-Origin Phosphates:** Constituting 25% of the world's phosphate output, these deposits are associated with alkaline intrusive complexes.
2. **Guano Deposits:** These deposits, contributing 5% of the world's phosphate production, possess relatively smaller reserves but remain of significance.
3. **Sedimentary Phosphates:** Accounting for a substantial 70% of global production, these deposits are the most widespread and voluminous. They form in continental margins and epicontinental seas where water-sediment interfaces are subject to periodic or occasional reworking (Baturin, 1982; Glenn et al., 1994; Föllmi, 1996; Pufahl & Groat, 2017). The formation of sedimentary phosphates is contingent upon upwelling currents, which play a pivotal role in supplying the sedimentary environment with phosphorus, silica, and fluorine.



Fig 1. Map depicting the spatial distribution of the different types of phosphate deposits worldwide (Pufahl & Groat, 2017).

Sedimentary phosphates are formed along continental margins and in epicontinental seas where the depth allows for a constant, periodic, or occasional reworking of the water-sediment interface (Baturin, 1982; Glenn et al., 1994; Föllmi, 1996; Pufahl & Groat, 2017).

The key element in the formation of these sedimentary phosphates is the action of the upwelling currents, which plays a role in supplying phosphorus, silica, and fluorine to the sedimentary environment that functions as a trap zone.

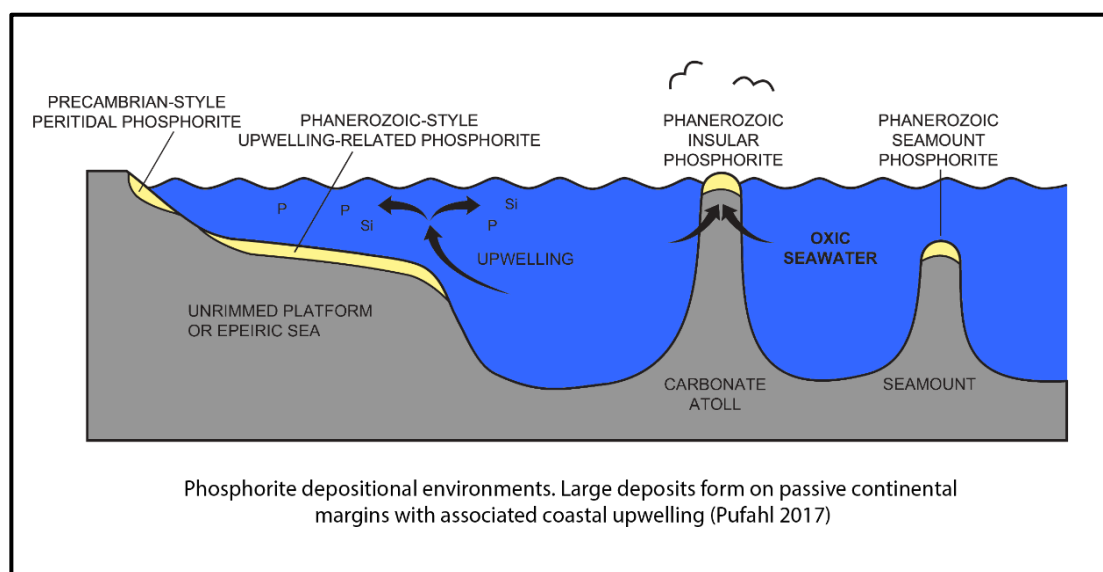


Fig 2. Different phosphorite depositional environments (Pufahl 2017).

II. The Moroccan Phosphate:

Moroccan phosphates are part of the South-Tethyan Phosphatogenic Province, a vast region that stretches approximately 5,500 kilometers from North Africa to the Middle East. Remarkably, this province holds a staggering 85% of the world's known phosphate reserves, as reported by Jasinski in 2020.

From a geological and stratigraphic standpoint, this province boasts an extensive age range, spanning from the Upper Cretaceous to the Paleogene, specifically from the Turonian to the Ypresian epochs, covering a time span of 46 million years.

Notably, Morocco stands as the epicenter of the global phosphate reserve landscape, with a commanding 72% share of the world's reserves and boasting the most substantial deposits on the planet.

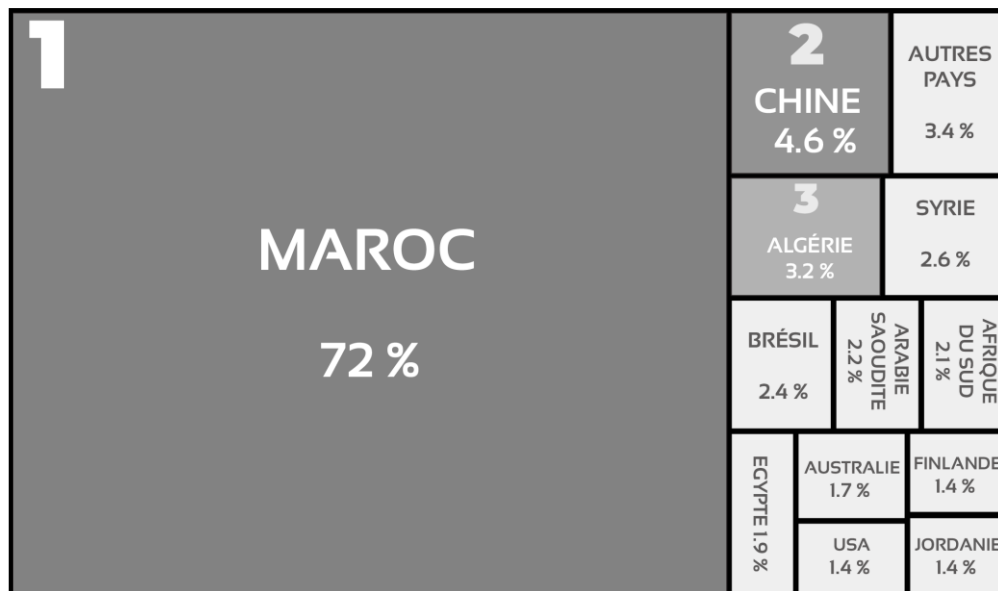


Fig 3. Distribution of phosphate reserves worldwide (Jasinski, 2020).

The Moroccan phosphate deposits are primarily of sedimentary nature, ranging from the Maastrichtian epoch to the Ypresian epoch, and are found in the Meseta, Atlas, and Saharan regions.

The Meseta Region: Here, the most significant deposits are found, both in terms of their extent and their high P_2O_5 content.

- Ouled Abdoun Basin (Khouribga region).
- Ganntour Basin (Ben Guerir-north of Marrakech region).
- Meskala Basin (Imin T'anout – Chichaoua regions, East of Essaouira).

The Atlas Region: In this region, there are phosphate deposits with very low economic interest.

- Souss and Ouarzazate Basins: South slope of the Western to Central High Atlas.
- Aït Ourir to Amez Miz region: North slope of the High Western High Atlas (High Atlas of Marrakech).

- Bekrit and Timahdit regions (Maastrichtian): Deposits in the Middle Atlas.

Saharan Region: Here, phosphate deposits of moderate economic interest are found, with the only basin in this domain being the Oued Eddahab Basin.

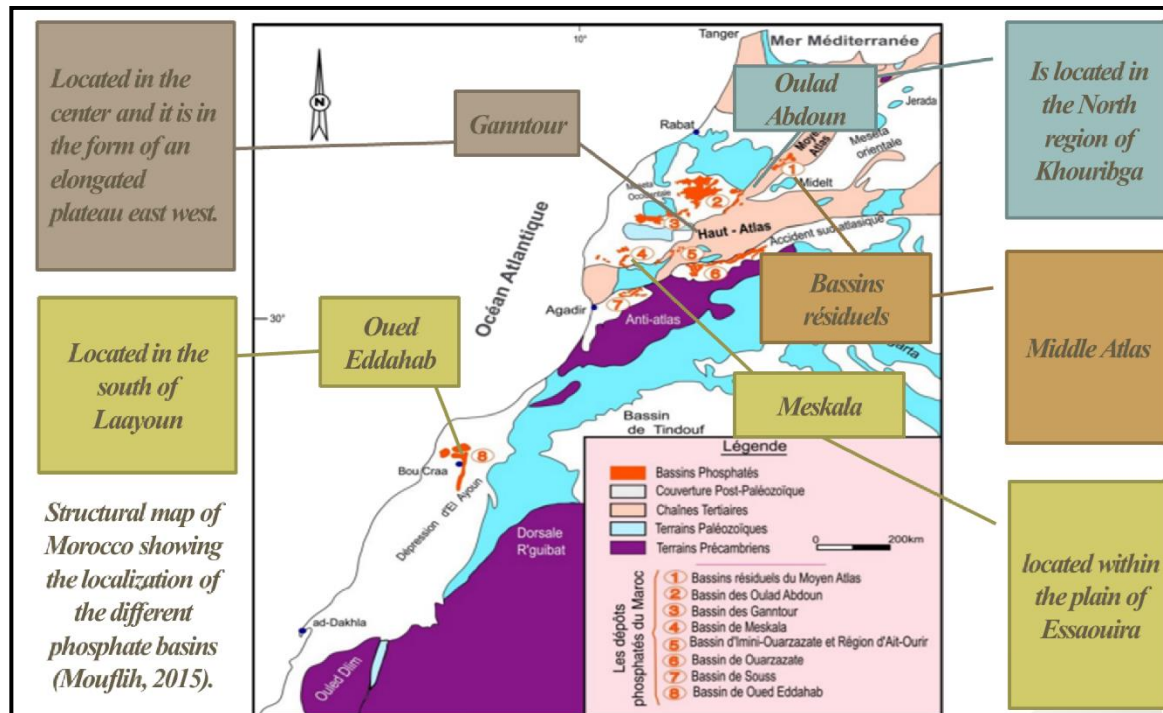


Fig 4. Structural map of Morocco showing the different phosphate basins (Mouflih, 2015).

These Moroccan phosphate deposits are characterized by a high phosphorus accumulation and low impurity levels.

These phosphates consist of phosphatic elements resembling fine wet sand and sterile elements (limestone, silica, clay-limestone gangue, etc.), with particle sizes ranging from a few millimeters to several tens of centimeters. They exhibit low concentrations of silica, iron, and alumina, but are generally quite carbonated.

III. The Paleogeography of the Maastrichtian of the western High Atlas:

The Geographical Context:

The Western High Atlas, more specifically, its southern side referred to as “the Souss-Ouarzazate Gulf” is a region distinguished by its geological division resulting from the uplift of the High Atlas Range, it is also characterized by the progressive transition from marine, through lagoonal, to continental facies along a west to east transect (Algouti et al., 2015).

The study area is located in the Western High Atlas, bounded to the north by the Western Meseta, to the south by the Anti-Atlas, to the east by the Central High Atlas, and to the west by the Agadir-Essaouira Basin. It encompasses the South Sub-Atlasic trough, which extends from Agadir and the Erguita trench in the west to the Aoulouz region in the east.

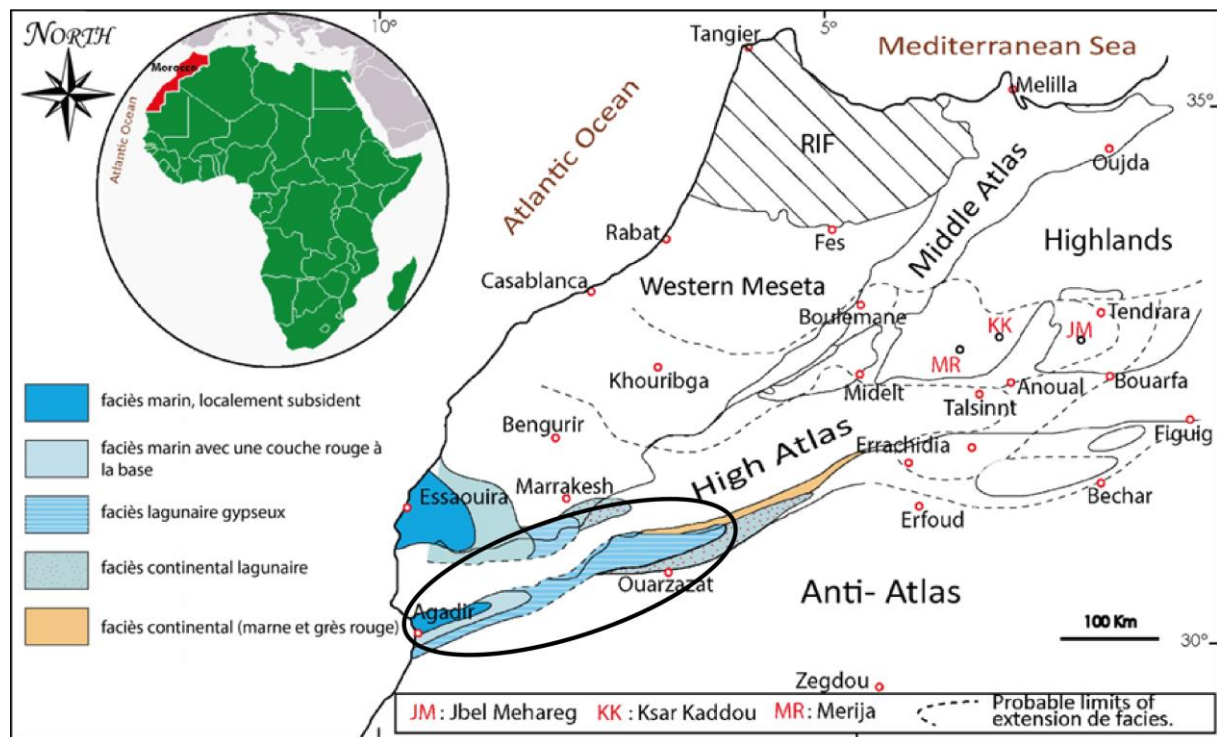


Fig 5. A location map illustrating the distinct facies within the study sectors. (Modified after Choubert and Faure-Muret 1960-62)

The Paleogeography:

During the Maastrichtian epoch, a substantial transgressive event originating from the Atlantic Ocean inundated the entire study region, encompassing the Moroccan coastline, the Saharan platform, southern Tunisia, and eastern Egypt. This transgression was driven by eustatic factors. However, it was preceded by a pre-Maastrichtian embryonic phase characterized by lithified strata at the roof of the Erguita region within the Oued Lahouar marl formation that is associated with an erosional surface overlain by micro-conglomerates. Notably, syndimentary faults and angular unconformities were identified at the base of the Maastrichtian, demarcating a significant geological shift. Furthermore, the transition coincided with the onset of phosphogenesis and the presence of colloidal silica seas.

The study area exhibits characteristics akin to small sedimentary basins, featuring lagoon-brackish influences in the eastern sector, which acted as morphological traps promoting the precipitation of phosphate minerals. The prevailing warm and arid climatic conditions facilitated the proliferation of vertebrate organisms, as evident in the Erguita Basin.

The absence of phosphogenesis in the Agadir Basin can be attributed to its geographical separation from the Erguita Basin by a shallower region. Researchers had previously identified this separation dating back to the Campanian period.

2.CONCLUSION

The surveyed sector manifests as follows:

The Agadir basin, which is in open communication with the sea, it is characterized by relatively deep fossiliferous sediments.



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The Erguita basin, it functions as a trap zone facilitating phosphate precipitation, within a hot and arid climate conducive to the proliferation of vertebrate organisms.

And the eastern portion behaves as small sedimentary basins exhibiting lagoon-brackish influences.

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DETERMINING THE MUTUAL WETTING CAPABILITIES OF OIL-WATER: POLYMER-ROCK IN SOME OIL FIELDS IN ALBANIA: A REVIEW

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ABSTRACT

As everywhere, the reservoirs are water-wet and sometimes alternate with oil-wet areas. In the case of examining the only well in Albania where polymer injection is carried out, that of Patos Marinza, we see the same rule, where, as a result, with the use of wells, the saturation of the night in the reservoir decreases, and as a result, the amount of oil will be called extractable oil. As a result, the wet oil parts of the layer will be reduced, and the water-wetting of the rock will be observed. Regarding the injection of the polymer, it is observed that it is greatly affected by the wettability of the core. Wettability is defined as the tendency of a liquid to spread or adhere to the surface of a solid surface in the presence of another immiscible fluid. Reservoir wettability is an important and elusive petro-physical parameter in all types of core analysis, which affects saturation and improves oil recovery processes. In the engineering concept for the exploitation of the oil reservoir, there is the opinion that in water-wet cores, injection is done more efficiently than in oil-wet cores, that is, more in the first stages of injection from water-wet rocks than oil-wet ones. The polymer flooding process involves the injection of a polymer "plug," followed by continuous and long-term water flooding to drive the polymer plug and the oil "bank" ahead of it toward the production wells. Based on the principle of mobility ratio, as we showed above, water-soluble polymers reduce water mobility by two mechanisms: a) by increasing the viscosity of the aqueous phase; b) by reducing the relative permeability of water in the rock pores; and c) by adsorption and retention of the polymer at the mouths of the rock pores, thus creating a more efficient and uniform front to displace the contained oil from the reservoir. The mineralogy of the analyzed samples showed a variable amount of dolomite in their composition, which consists of dolomite grains and a small amount of dolomicrite in excellent form. The quality of the sand reservoir in Driza seems to be very good. The porous sand and pore system are practically immaculate. This can create a problem with narrow-pored throats. Injection of the polymer is also associated with the concern of its stability against several factors. The factors that affect the stability of the polymer, and therefore its effectiveness, are injection pressure, temperature, stirring speed, salinity of water, etc.

Keywords: Polymer Injection, Oil Reservoirs, Petro-Physical Parameters, Wettability.

1. INTRODUCTION



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Review of Related Literature on Mutual Wetting Capabilities of Oil-Water: Polymer: *Rock in Some Oil Fields in Albania.*

The mutual wetting capabilities of oil-water, polymer, and rock play a crucial role in the efficiency of oil recovery processes in oil fields. Understanding the interfacial interactions between these components is essential for optimizing oil production techniques. This literature review aims to explore the current knowledge and research findings on the mutual wetting capabilities of oil-water, polymer, and rock in some oil fields in Albania. The most important parameters influencing the direction of the better oil production using polymers, which have been distinguished from the other factors, are as follows:

Interfacial Tension and Wettability

Interfacial tension (IFT) and wettability are key parameters that influence the behaviour of fluids in porous media. The IFT between oil and water determines the capillary forces, which affect the displacement efficiency during oil recovery processes. The wettability of rock surfaces determines the preferential wetting phase and affects the distribution of fluids within the reservoir.

Polymer Flooding

Polymer flooding is an enhanced oil recovery technique that injects polymer solutions into the reservoir to improve oil displacement efficiency. The success of polymer flooding depends on the mutual wetting capabilities of oil-water, polymer, and rock. Understanding the interactions between these components is crucial for designing effective polymer flooding processes.

Mutual Wetting Capabilities in Albanian Oil Fields

Limited research has been conducted on the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields. However, some studies have shed light on this topic. For instance, a study by Xhafa et al. (2018) investigated the wettability alteration of carbonate reservoir rocks in the Patos-Marinza oil field. The research revealed that the addition of polymers to the injected water altered the wettability of the rocks, leading to improved oil recovery. Another study by Krasniqi et al. (2019) evaluated the effect of different polymers on the interfacial tension between oil and water in the Albanian oil fields. The results showed that certain polymer additives reduced the IFT, enhancing the oil recovery process. The study also highlighted the importance of polymer concentration and molecular weight in determining mutual wetting capabilities. Understanding the mutual wetting capabilities of oil, water, polymer, and rock in oil fields in Albania involves studying the interactions at the oil-water-rock interfaces and how they affect wettability and capillary forces. While there is limited information specifically about oil fields in Albania, here are some general points to consider:

Wettability Alteration: Wettability alteration refers to changing the wetting properties of the rock surface from oil-wet to water-wet. This alteration is crucial for enhanced oil recovery (EOR), as it improves the displacement of oil by water (Liu, et al., 2021). The favorable wettability alteration towards water-wet conditions has been identified as the primary mechanism for incremental oil recovery (Almorihil et al., 2021).

Polymer Flooding Techniques: Polymer flooding is an EOR method that involves injecting polymer solutions into the reservoir to improve sweep efficiency and the displacement of oil. Polymer flooding techniques can also affect rock wettability. However, specific details about



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the effects of polymer flooding on rock wettability in Albanian oil fields are not readily available.

Pore-Scale Dynamics: The dynamics of water injection in oil-wet reservoir rocks play a significant role in understanding wetting capabilities. Studies have shown that water advances as a connected front, displacing oil in the center of the pores and confining the oil to wetting layers (Alhosani, 2020). The displacement process is an invasion percolation process, where throats between pores fill in order of size. It is important to note that the specific mutual wetting capabilities of oil-water, polymer, and rock in oil fields in Albania may vary depending on the geological characteristics of the reservoirs and the specific EOR techniques employed. Further research and studies specific to Albanian oil fields would provide more detailed insights into this topic.

The impact of rock wettability on oil recovery in Albania's oil fields is significant. The wettability of a rock affects the displacement of oil by water from the oil-producing reservoir rocks. Wettability plays an important role in oil recovery because of its effect on fluid location, flow behavior, and residual oil distribution (Wettability, 2012). The favorable wettability alteration towards water-wet conditions has been identified as the main mechanism responsible for incremental oil recovery. The influence of wettability on oil recovery is profound, and it depends on the reservoir mineralogy, the adsorption of hydrocarbon constituents, and the spreading capability of the oil phase. Therefore, understanding the mutual wetting capabilities of oil, water, polymer, and rock is crucial for enhanced oil recovery. Further research and studies specific to Albanian oil fields would provide more detailed insights into this topic (Agbalaka et al., 2008).

The degree of depletion of oil operated by the primary methods using energy reserves small, and in most cases does not exceed 5% to 30% of the geological resources. The exploitation of these deposits it is more effective when they are methods used to support the extraction (secondary and tertiary methods), allows for additional oil extraction by providing for additional deposits. The application of these methods allows a double to increase in the oil recovery. The best results are achieved when secondary and tertiary methods are matched to the parameters of oil and field conditions, including petrophysical properties such as relative permeability, saturation, and wettability.

The wettability type of reservoir rocks and their impact on the petrophysical properties are crucial in determining the oil recovery mechanisms and estimating the efficiency of their production. Numerous studies indicate that wettability is one of the main factors controlling and regulating the spread of oil and water in the reservoir rock (Url 1.; Url 2; Arekhov et al., 2020). The characterization of the wettability of reservoir rock plays an essential role in optimizing oil recovery. Nature's wettability (hydrophobic or hydrophilic) affects the behavior of reservoir rock, in particular for the waterflooding of the deposit and in the case of using advanced methods of oil recovery. For example, a wrong assumption of the hydrophilic nature of the rocks, where they are hydrophobic, can lead to permanent damage deposits and complicate the process of its operation [Arekhov et al., 2020; Sheng, 2011; Arekhov et al., 2020).

• **The mutual wetting capabilities of oil-water can affect oil recovery in Albanian oil fields in several ways:** Wettability determines the efficiency of gasflood oil recovery. According to a review article on the effect of wettability on oil recovery, it has been shown that wettability



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determines the gasflood oil recovery efficiency, and changes in wetting states have resulted in observed improved recovery.

- **Rock wettability alteration towards more water-wetting conditions can improve oil recovery:** A study on water flooding in oil reservoirs found that rock wettability alteration towards more water-wetting conditions helps improve oil recovery. This is because the strong wetting preference of the rock for water and associated strong capillary-imbibition forces give the most efficient oil displacement.

- **Enhanced Oil Recovery (EOR) technologies can improve oil recovery:** According to a review of EOR status and opportunities to increase final recovery factors in reservoirs ranging from extra heavy oil to gas condensate, EOR technologies will play a key role in meeting the energy demand in years to come. EOR techniques such as waterflooding, thermal EOR, gas EOR, chemical EOR, and combined EOR can improve the mutual wetting capabilities of oil-water, polymer, and rock and increase oil recovery.

- **Heavy oil production requires EOR technologies:** According to a report on the characterization of crude oil from various oil fields in Albania, the majority of Albania's oil produced is heavy oil, meaning lower recovery rates and circumstances requiring EOR technologies.

Overall, the mutual wetting capabilities of oil-water can affect oil recovery in Albanian oil fields, and EOR technologies can be used to improve oil recovery rates.

Overall, the current EOR techniques used in Albanian oil fields to improve oil recovery through mutual wetting capabilities of oil-water include waterflooding, thermal EOR, gas EOR, chemical EOR, and combined EOR. These techniques are used to improve the mutual wetting capabilities of oil-water, polymer, and rock and increase oil recovery (Buranaj Hoxha et al., 2019).

Are there any case studies or success stories of EOR techniques that improve mutual wetting capabilities of oil-water in Albanian oil fields?

While there is no specific experimental setup or laboratory schematic facility for studying the improved mutual wetting capabilities of oil-water in Albanian oil fields, the experimental methods for studying the wetting properties of oil reservoirs and laboratory waterfloods can provide insights into the mutual wetting capabilities of oil-water, polymer, and rock in the region.

The research findings on the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields have several implications for oil extraction in the region. Some of these implications are:

- The study highlights the importance of understanding the wettability of different materials in oil recovery. This knowledge can help in the development of more effective oil extraction techniques in Albanian oil fields.

- The research findings suggest that the mutual wetting capabilities of oil, water, polymer, and rock can be influenced by various factors, such as surface tension and contact angle. Therefore, it is important to consider these factors when designing oil recovery processes (Url 3).



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→ The study may have implications for the development of waste-to-fuel technology in Albanian oil fields. This technology could help to implement a renewable energy system in Europe's largest onshore oilfield.

The research findings could contribute to the broader understanding of wettability and wetting behaviour in other geological and industrial contexts. The study could also inform future research on the potential applications of the findings in developing new materials or technologies for oil recovery. The limitations of the research study on the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields are not explicitly stated in the search results. However, some limitations can be inferred based on the nature of the study and the available information. These limitations include:

The study focuses only on the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields. Therefore, the findings may not be generalizable to other oil fields or geological contexts (Kokinou et al. 2017).

The study may not have considered all the factors influencing the mutual wetting capabilities of oil-water, polymer, and rock. For example, the study may not have explored the effects of temperature, pressure, or the presence of other chemicals on wettability (Buranj Hoxha, 2022).

The study may have relied on laboratory experiments or simulations, which may not fully capture the complexity of real-world oil recovery processes in Albanian oil fields.

The study may not have considered the economic or environmental implications of the findings for oil extraction in Albanian oil fields.

The search results need to provide specific information on the oil fields in Albania that were studied in the research paper on the mutual wetting capabilities of oil-water, polymer, and rock. However, some of the search results provide information on oil production and extraction, which can help provide context for the study. So, it is difficult to determine how representative the findings are of the entire country. However, the information on oil production and extraction in Albania suggests that the study may have focused on oil fields in the Durres Basin and the Ionian unit, major oil production areas in the country. Nonetheless, further information is needed to determine the specific oil fields studied and their representativeness.

2. CONCLUSION

In conclusion, the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields have been investigated to a limited extent. However, the available studies suggest that polymers can alter the wettability of rocks and reduce the interfacial tension between oil and water, leading to improved oil recovery. Further research is needed to explore the specific mechanisms and optimize the use of polymers in oil production processes in Albania.

Conclusions for the research paper titled "The Mutual Wetting Capabilities of Oil-water, Polymer, and Rock in Albanian Oil Fields" could include:

The study found that oil-water, polymer, and rock wettability in Albanian oil fields is an essential factor in oil recovery; the research showed that various factors, such as surface tension and contact angle, can influence the mutual wetting capabilities of these materials; the study may have implications for developing more effective oil recovery techniques in Albanian oil fields.



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The findings of this research could also contribute to the broader understanding of wettability and wetting behaviour in other geological and industrial contexts. Further research could explore the potential applications of the study's findings in developing new materials or technologies for oil recovery.

Based on the research study on the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields, the following recommendations for oil extraction can be made:

- The study highlights the importance of understanding the wettability of different materials in oil recovery. Therefore, it is recommended that oil extraction companies in Albanian oil fields consider the mutual wetting capabilities of oil-water, polymer, and rock when designing oil recovery processes;
- The research findings suggest that the mutual wetting capabilities of oil, water, polymer, and rock can be influenced by various factors, such as surface tension and contact angle. Therefore, it is recommended that oil extraction companies in Albanian oil fields take these factors into account when designing oil recovery processes.
- The study may have implications for the development of waste-to-fuel technology in Albanian oil fields. Therefore, it is recommended that oil extraction companies in Albanian oil fields explore the potential of this technology to implement a renewable energy system in the region.
- The research findings could contribute to the broader understanding of wettability and wetting behaviour in other geological and industrial contexts. Therefore, it is recommended that oil extraction companies in other regions consider the study's findings when designing oil recovery processes. Further research could explore the potential applications of the study's findings in the development of new materials or technologies for oil recovery. Therefore, it is recommended that oil extraction companies in Albanian oil fields invest in research to develop more effective and sustainable oil recovery techniques.

Based on the search results, potential future research directions in the field of mutual wetting capabilities of oil-water, polymer, and rock in some oil fields in Albania could include:

- ♣ Further exploration of the factors that influence the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields. This could include investigating the effects of temperature, pressure, and the presence of other chemicals on wettability.
- ♣ Development of new materials or technologies for oil recovery based on the study's findings. For example, the study could inspire the development of new surfactants or polymers that can improve the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields.
- ♣ Investigation of the economic and environmental implications of the study's findings for oil extraction in Albanian oil fields. This could include assessing the cost-effectiveness and sustainability of different oil recovery techniques based on their mutual wetting capabilities.
- ♣ Further characterization of crude oil from various oil fields in Albania through instrumental analysis techniques such as gas chromatography-mass spectrometry (GC-MS), Fourier transform infrared spectroscopy (FTIR), and nuclear magnetic resonance (NMR) spectroscopy. This could help to understand better the chemical and physical properties of crude oil in Albanian oil fields and their potential implications for oil recovery.



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The following are some ways in which the findings can be used to improve oil recovery in Albanian oil fields:

- a. Consideration of mutual wetting capabilities in oil recovery processes: The study highlights the importance of understanding the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields. Therefore, oil extraction companies in Albanian oil fields can consider the mutual wetting capabilities of these materials when designing oil recovery processes. This can help to develop more effective and sustainable oil recovery techniques.
- b. development of new materials or technologies for oil recovery: The research findings suggest that various factors, such as surface tension and contact angle, can influence the mutual wetting capabilities of oil-water, polymer, and rock. Therefore, the study could inspire the development of new surfactants or polymers to improve the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields. This could lead to more effective and sustainable oil recovery techniques.
- c. Investigation of waste-to-fuel technology: The study may have implications for developing waste-to-fuel technology in Albanian oil fields. This technology could help to implement a renewable energy system in Europe's largest onshore oilfield.
- d. characterization of crude oil through instrumental analysis: The characterization of crude oil from various oil fields in Albania through instrumental analysis techniques such as gas chromatography-mass spectrometry (GC-MS), Fourier transform infrared spectroscopy (FTIR), and nuclear magnetic resonance (NMR) spectroscopy, can help to understand better the chemical and physical properties of crude oil in Albanian oil fields. This can inform the development of more effective and sustainable oil recovery techniques.
- e. Investigation of Enhanced Oil Recovery (EOR) technologies: With the decline in oil discoveries during the last decades, it is believed that Enhanced Oil Recovery (EOR) technologies will play a key role in meeting the energy demand in future years. Therefore, oil extraction companies in Albanian oil fields can investigate EOR technologies to increase final recovery factors in reservoirs ranging from extra heavy oil to gas condensate.

Final Considerations for Mutual Wetting Capabilities of Oil-Water: Polymer: Rock in Some Oil Fields in Albania:

- ✓ Many studies highlight the importance of understanding the mutual wetting capabilities of oil-water, polymer, and rock in Albanian oil fields to improve recovery.
- ✓ The research findings suggest that various factors, such as surface tension and contact angle, can influence the mutual wetting capabilities of oil-water, polymer, and rock. Therefore, it is essential to consider these factors when designing oil recovery processes.
- ✓ The study may have implications for developing waste-to-fuel technology in Albanian oil fields. This technology could help to implement a renewable energy system in Europe's largest onshore oilfield.
- ✓ The research findings could contribute to the broader understanding of wettability and wetting behaviour in other geological and industrial contexts.



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- ✓ The current oil recovery methods used in Albanian oil fields include primary oil extraction techniques, EOR techniques, transfer of heavy-oil technology, and onshore and offshore oil and gas opportunities.
- ✓ The EOR techniques used in Albanian oil fields include waterflooding, thermal EOR, gas EOR, chemical EOR, and combined EOR.

Potential future research directions in the field of mutual wetting capabilities of oil-water, polymer, and rock in some oil fields in Albania could include: further exploration of the factors that influence mutual wetting capabilities, development of new materials or technologies for oil recovery, Investigation of the economic and environmental implications of the study's findings, further characterization of crude oil through instrumental analysis, and Investigation of Enhanced Oil Recovery (EOR) technologies.

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A SURVEY OF MACHINE LEARNING-BASED PREDICTION METHODS FOR HEART DISEASE

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ABSTRACT

The heart is one of the body's most vital organs. All of the body's organs benefit from improved blood circulation and filtration. Heart diseases are to blame for the majority of deaths worldwide. There are other symptoms that are noted, including as chest pain, a rapid heartbeat and difficulty breathing. This information is regularly analyzed. This review starts off with a general introduction of heart disease and the current treatments. Additionally, a thorough examination of the most pertinent machine learning methods for heart disease prediction that have been documented in the literature is briefly elaborated. Decision tree, SVM, ANN, Naïve Bayes, Random Forest, and KNN are some of the machine learning algorithm that have been discussed, The algorithms are contrasted based on their properties. On the most accurate algorithm, we are now working. This will make it easier for the doctors to treat the cardiac issue.

Keywords: Machine Learning, Prediction, Classification Technique, Decision Tree, Accuracy.

1. INTRODUCTION

Heart disease affects the functioning of the heart. World Health Organization had made a survey and made a conclusion that 10 million people are affected with heart disease and lost their lives. The problem that the Healthcare industry faces in today's life is early prediction of disease after a person is affected. Records or data of medical history is very large and the data in the real world might be incomplete and inconsistent. In the past predicting the disease effectively and treatment to patients might not be possible for every patient at early stages under these circumstances. Many scientists tried to build a model which is capable of predicting the heart disease in the early stage, but they are not able to build a perfect model. Every proposed system has disadvantages in its own way. In the existing system, Shen et al. had initially proposed a system which is based on self-applied questionnaire. In this system the user needs to enter all the symptoms which he is suffering from, based on that the result is predicted. This study is based on the analysis data collected in SAQ. Chen et al. came up with an idea to predict heart disease. He used the technique of Vector Quantization which is one of the artificial intelligence techniques for classification and prediction purposes. Training of neural networks is performed using back propagation to evaluate the prediction system. In the testing phase approximately 80% accuracy is achieved on the testing set. Practical use of data collected from previous records is time consuming. Low accuracy rate. So to overcome this we are implementing Random forest algorithm in order to achieve accurate results in less time. Machine learning is given a major priority in modern life in many applications and in the healthcare sector. Prediction is one of the areas where machine learning plays a vital role. Our topic is to predict heart disease by processing patient's dataset and a data of patients i.e., user of whom we need to predict the chances of occurrence of a heart disease.



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Heart disease can be detected using symptoms like: high blood pressure, chest pain, hypertension, cardiac arrest, etc. There are many types of heart diseases with different types of symptoms. Like: 1) heart disease in blood vessels: chest pain, shortness of breath, pain in neck Throat. 2) Heart disease caused by abnormal heartbeats: slow heartbeat, discomfort, chest pain. etc. Most common symptoms are chest pain, shortness of breath, discomfort, chest pain. etc. Most common symptoms are chest pain, shortness of breath, fainting. Causes of heart disease are defects you're born with, high blood pressure, diabetes, smoking, drugs, and alcohol. Sometimes in heart disease the infection also affects the inner membrane, which is identified by symptoms like fever, fatigue, dry cough, skin rashes. Causes of heart infection are bacteria, viruses, parasites. Types of heart disease: Cardiac arrest, Hypertension, Coronary artery disease, Heart failure, Heart infection, congenital heart disease, slow heartbeat, Stroke type heart disease, angina pectoris. Nowadays there are too many automated techniques to detect heart disease like data mining, machine learning, deep learning, etc. So, in this paper we will briefly introduce machine learning techniques. In this we train the datasets using the machine learning repositories. There are some risk factors on the basis of that the heart disease is predicted. Risk factors are: Age, Sex, Blood pressure, Cholesterol level, Family history of coronary illness, Diabetes, Smoking, Alcohol, Being overweight, Heart rate, Chest Pain.

A. Problem Statement

Heart disease can be managed effectively with a combination of lifestyle changes, medicine and, in some cases, surgery. With the right treatment, the symptoms of heart disease can be reduced and the functioning of the heart improved. The predicted results can be used to prevent and thus reduce cost for surgical treatment and other expensive.

B. Objectives

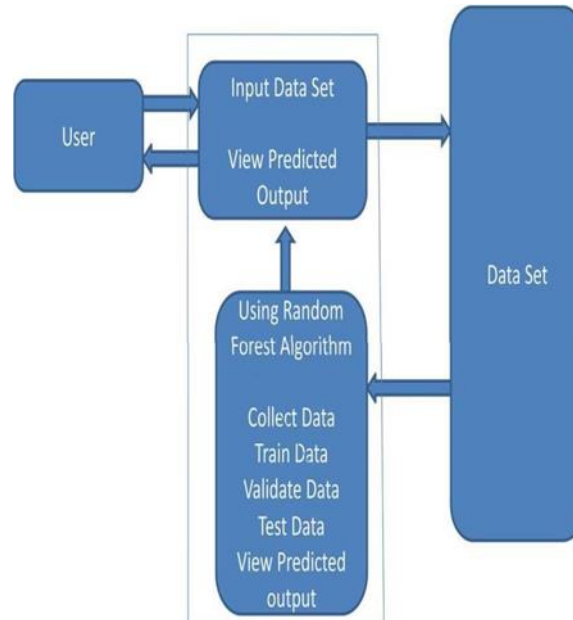
The main objective of this research is to develop a heart prediction system. The system can discover and extract hidden knowledge associated with diseases from a historical heart data set. Heart disease prediction system aims to exploit data mining techniques on medical data set to assist in the prediction of the heart diseases.

C. Methodology

Figure 1 depicts the overall process of this work. Our aim is to build an application of heart disease prediction system using robust Machine Learning algorithm which is Random Forest algorithm. A CSV file is given as input. After the successful completion of operation the result is predicted and displayed. The working of the system starts with the collection of data and selecting the important attributes. Then the required data is pre- processed into the required format. The data is then divided into two parts training and testing data. The algorithms are applied and the model is trained using the training data. The accuracy of the system is obtained by testing the system using the testing data. This system is implemented using the following modules.

- 1) Collection of Dataset
- 2) Selection of attributes
- 3) Data Pre-Processing
- 4) Balancing of Data

5) Disease Prediction

**Fig. 1** Block diagram of proposed system**2. LITERATURE SURVEY**

This section discusses the state-of-the-art methods for heart disease diagnosis using machine learning techniques that were accomplished by various effective research works. R. Perumal et al. [18] developed a heart disease prediction model using the Cleveland dataset of 303 data instances through feature standardization and feature reduction using PCA, where they identified and utilized seven principal components to train the ML classifiers. They concluded that LR and SVM provided almost similar accuracy values (87% and 85%, respectively) compared to that of k-NN with 69%. Latha et al. [19] performed a comparative analysis to improve the predictive accuracy of heart disease risk using ensemble techniques on the Cleveland dataset of 303 observations. They applied the brute force method to obtain all possible attribute set combinations and trained the classifiers. They achieved a maximum increase in the accuracy of a weak classifier of 7.26% based on ensemble algorithm, and produced an accuracy of 85.48% using majority vote with NB, BN, RF, and MLP classifiers using an attribute set of nine attributes. Ananey-Obiri et al. [20] developed three classification models, namely, LR, DT, and Gaussian naïve Bayes (GNB), for heart disease prediction based on the Cleveland dataset. Feature reduction was performed using single value decomposition, which reduced the features from 13 to 4. They concluded that both LR and GNB had predictive scores of 82.75% and AUC of 0.87. It was suggested that other models, such as SVM, k-NN, and random forest, be included. Kumar et al. [21] trained five machine learning classifiers, namely, LR, SVM, DT, RF, and KNN, using a UCI dataset with 303 records and 10 attributes to predict cardiovascular disease. The RF classifier achieved the highest accuracy of 85.71% with an ROC AUC of 0.8675 compared to the other classifiers. Gupta et al. [22] replaced the missing values based on the majority label and derived 28 features using the Pearson correlation coefficient from the Cleveland dataset and trained LR, KNN, SVM, DT, and RF classifiers using the factor analysis of mixed data (FAMD) method; the results based on a weight matrix RF



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achieved the best accuracy of 93.44%. Sultana et al. [23] explored KStar, J48, sequential minimal optimization (SMO), BN, and MLP classifiers using Weka on a standard heart disease dataset from the UCA repository with 270 records and 13 attributes; they achieved the highest accuracy of 84.07% with SMO. Mohan et al. [24] developed an effective hybrid random forest with a linear model (HRFLM) to enhance the accuracy of heart disease prediction using the Cleveland dataset with 297 records and 13 features. They concluded that the RF and LM methods provided the best error rates. Kodati et al. [25] developed a heart disease prediction system (HDPS) with the Cleveland dataset of 297 instances and 13 attributes using Orange and Weka data mining tools, where they evaluated the precision and recall metrics for the naïve Bayes, SMO, RF, and KNN classifiers. Ed-daoudy et al. [26] researched the Cleveland dataset of 303 records and 14 attributes from UCI. They evaluated the performance of the four main classifiers, namely, SVM, DT, RF, and LR, using Apache Spark with its machine learning library MLlib. Tougui et al. [27] compared the performances of LR, SVM, KNN, ANN, NB, and RF models to classify heart disease with the Cleveland dataset with 297 observations and 13 features using six data mining tools: Orange, Weka, RapidMiner, Knime, MATLAB, and Scikit-Learn. Pavithra et al. [28] proposed a new hybrid feature selection technique with the combination of random forest, AdaBoost, and linear correlation (HRFLC) using the UCI dataset of 280 instances to predict heart disease. Eleven (11) features were selected using filter, wrapper, and embedded methods; an improvement of 2% was found for the accuracy of the hybrid model. Gazeloglu et al. [29] projected 18 machine learning models and 3 feature selection techniques (correlation-based FS, chi-square, and fuzzy rough set) to find the best prediction combination for heart disease diagnosis using the Cleveland dataset of 303 instances and 13 variables. Louridi et al. [30] proposed a solution to identify the presence/absence of heart disease by replacing missing values with the mean values during pre-processing. They trained three machine learning algorithms, namely, NB, SVM (linear and radial basis function), and KNN, by splitting the Cleveland dataset of 303 instances and 13 attributes into 50:50, 70:30, 75:25, and 80:20 training and testing ratios. Kavitha et al. [31] implemented a novel hybrid model on the Cleveland heart dataset of 303 instances and 14 features with a 70:30 ratio for training and testing by applying DT, RF, and hybrid (DT + RF) algorithms. Tama et al. [32] designed a stacked architecture to predict heart disease using RF, gradient boosting machine, and extreme gradient boosting with particle swarm optimization (PSO) feature selection using various heart disease datasets, including the Cleveland with 303 instances and 13 attributes.

From the experimental works, it is understood that data pre-processing and feature selection can substantially enhance the classification accuracy of machine learning algorithms. During pre-processing, most researchers [18,19,21,22,26,29–32] replaced the missing values, either by using the mean value or the majority mark of that attribute, to make sure the dataset was comprehensive. In some works [20,24,25,27], the missing valued instances were removed. Feature selection is a challenging task due to the large exploration space. It grows exponentially according to the number of features available in the dataset. To solve this issue, an effective comprehensive search technique is required during feature selection. Furthermore, some studies have employed ensemble models, which combine multiple basic learning algorithms to obtain a better prediction accuracy. However, the performance of these techniques can further be improved regarding accurately predicting disease.

3. SYSTEM DESIGN

System design is thought of as the application of the theory of the systems for the development of the project. System design defines the architecture, data flow, use case, class, sequence and activity diagrams of the project development.

A. System Architecture

The below architecture diagram in Figure 2 illustrates how the system is built and is the basic construction of the software method. Creation of such structures and documentation of these structures is the main responsibility of software architecture.

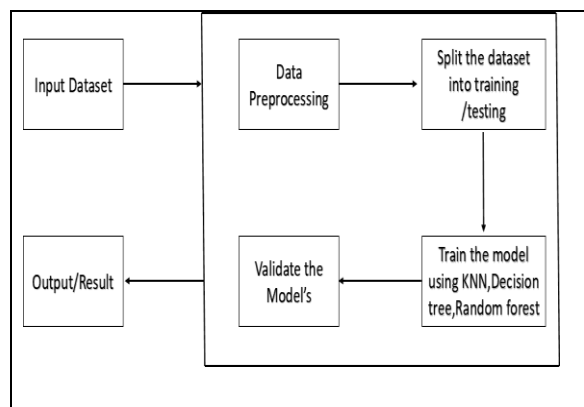


Fig. 2 Architecture diagram of proposed system

The working principle of the system is shown in Fig. 2.

1) **Input Dataset:** The user enters the input.

2) **Data Pre-Processing:**

It can refer to manipulation or dropping of data before it is used in order to ensure or enhance performance and is an important step in the data mining process. Data pre-processing is an important step for the creation of a machine learning model. Initially, data may not be clean or in the required format for the model which can cause misleading outcomes. In pre-processing of data, we transform data into our required format. It is used to deal with noises, duplicates, and missing values of the dataset. Data pre-processing has activities like importing datasets, splitting datasets, attribute scaling, etc. Pre-processing of data is required for improving the accuracy of the model.

3) **Split Dataset Into Train and Test:**

The train-test split is used to estimate the performance of machine learning algorithms that are applicable to prediction-based Algorithms/Applications. This method is a fast and easy procedure to perform such that we can compare our machine learning model results to machine results.

4) **Train the Model:** Input which is compared with the data present in the existing data set by using the Random Forest Algorithm. It is an efficient ML algorithm that comes under supervised learning technique. It is used for both Regression and Classification problems. To solve a complex problem, it uses a process of combining multiple classifiers, to increase the accuracy



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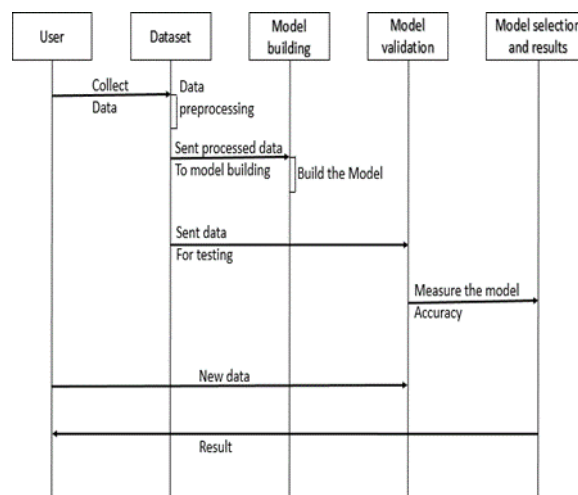
and performance of the model. "Random Forest is known as classifier that contains a greater number of decision trees on different subsets of the given dataset and considers the average to improve the predictive accuracy of that dataset."

5) Validate: Model validation refers to the process of confirming that the model actually achieves its intended purpose. In most situations, this will involve confirmation that the model is predictive under the conditions of its intended use.

6) Output or Result: Dataset collection is collecting data which contains patient details. Attributes selection process selects the useful attributes for the prediction of heart disease. After identifying the available data resources, they are further selected, cleaned, and made into the desired form. Different classification techniques as stated will be applied on pre-processed data to predict the accuracy of heart disease. Accuracy measure compares the accuracy of different classifiers.

B. Flowchart

The first step is to collect data on patients, which typically includes demographic information as well as medical history. The data is then cleaned and pre-processed to prepare it for analysis. The dataset is then split into training and testing sets. The training set is used to train the machine learning model, and the testing set is used to evaluate its performance. Various supervised learning algorithms can be used to train the model, such as logistic regression, decision trees, or neural networks. The accuracy of the model is then evaluated using the testing set. The model can be further optimized by adjusting the hyper parameters using techniques such as cross-validation and grid search. Once the model is optimized, it can be deployed in a real-world setting to predict the likelihood of heart disease in new patients.



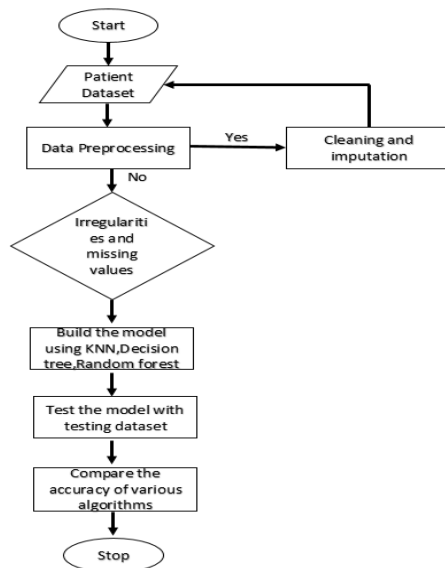


Fig. 3 Flowchart for heart prediction system

C. Sequence Diagram

A sequence diagram is a type of UML (Unified Modeling Language) diagram that depicts the interactions between objects or components in a system or process. It shows the order in which messages are exchanged between the objects, along with the time sequence of those messages. Below figure 4 shows the sequence diagram of crop and fertilizer recommendation.

Heart Disease Classifier

[Home](#) [Analysis](#)

Train Classifier

Age:

Gender:

Trest Bps:

chol:

lbs:

restecg:

thalach:

exang:

Fig. 4. Sequence diagram of crop recommendation



4. RESULTS

Fig. 5 Home Page Fig 6 shows the home page of our proposed system, which includes various parameters text field to input the user data. It has also train classifier button to train the ML model.

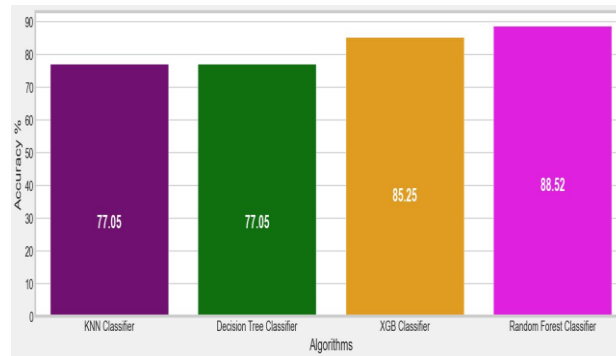


Fig. 6. Accuracy of different ML algorithms is compared

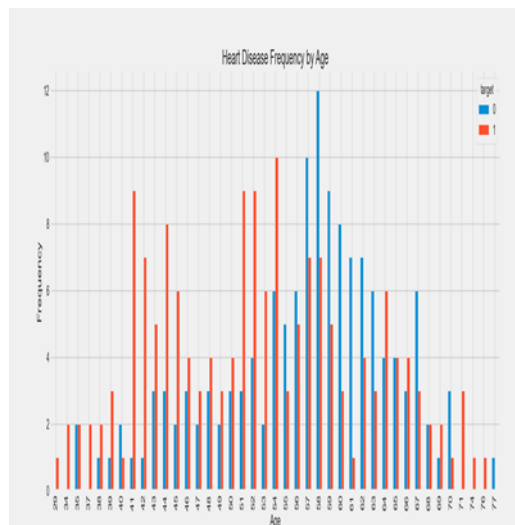


Fig. 7. Heart disease datasets represented

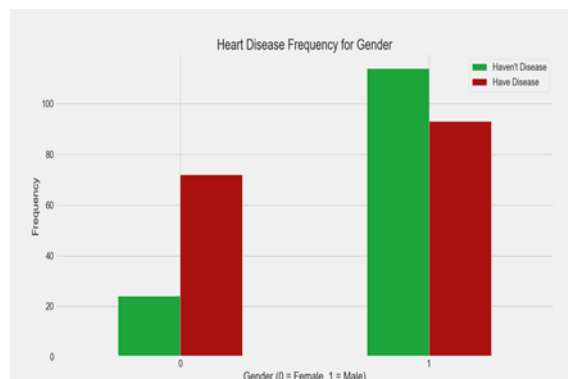


Fig. 8. Heart disease datasets represented based on Gender-frequency

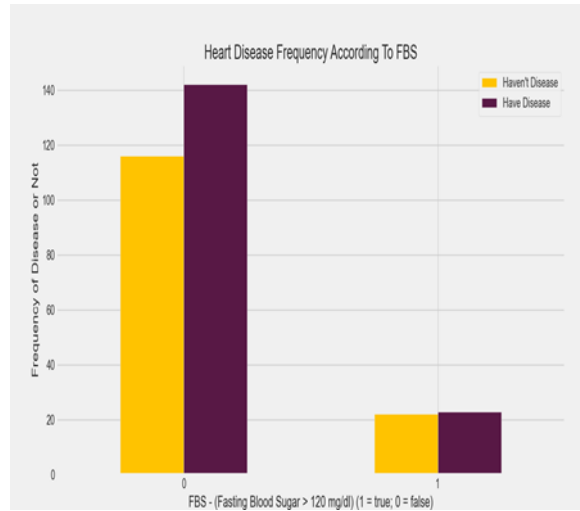


Fig. 9. Heart disease datasets represented based on FBS-frequency

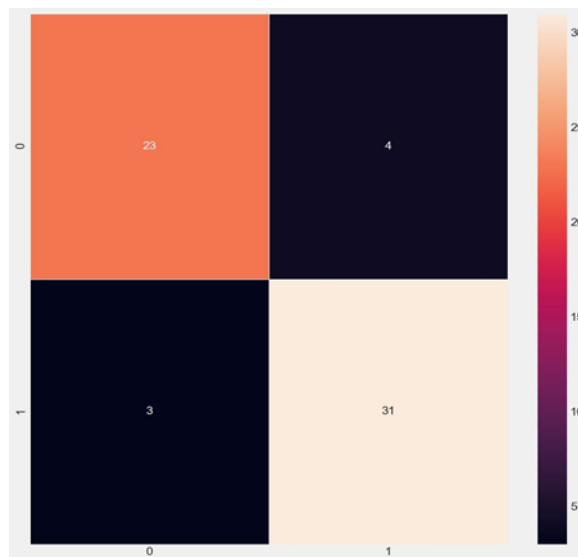


Fig. 10. Confusion Matrix of Random Forest Algorithm which we applied for prediction based on age-frequency



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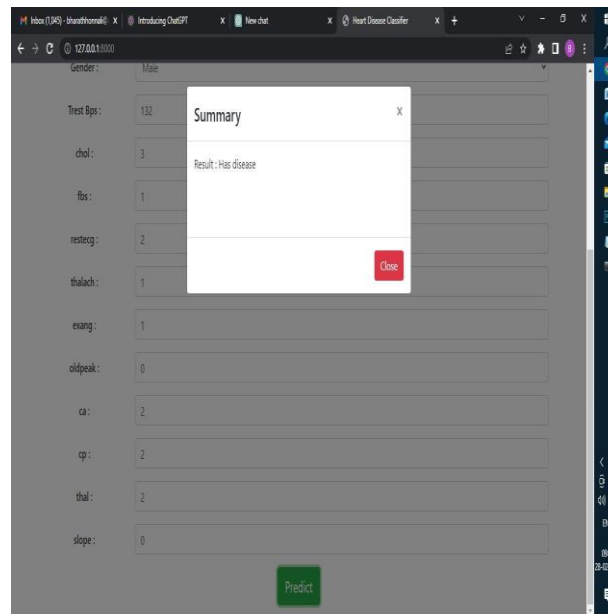


Fig. 11. Predicting result based on the User Input

5. CONCLUSION

Heart disease prediction is a major challenge in present modern life. With this application if the patient/user is away from reach of doctor, he/she can make use of the application in prediction of disease just by entering the report values. And can proceed further whether to consult a doctor or not.

6. FUTURE SCOPE

In future this application can be extended by updating some features like, if the user is affected with heart disease all his family members will be notified with a message in early. And also, the information should be passed to the nearest hospital. Another feature is there should be online doctor consultation with the nearest doctor available. In this regard, it is important to note that, ML applications using various efficient algorithms are utilized not only in disease prediction and diagnosis but also in the field of radiology, bioinformatics and medical imaging diagnosis etc.

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X-RAY AND CT IMAGES IN COVID-19 DETECTION USING IMAGE PROCESSING AND DEEP LEARNING TECHNIQUES: A COMPARATIVE STUDY

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ABSTRACT

Millions of lives have been destroyed by the deadly coronavirus, which has also put a tremendous amount of burden on the entire healthcare system. Early identification of COVID-19 is essential to isolating positive cases and halting the spread of the illness. For COVID-19 detection, combining deep learning algorithms with medical imagery led to faster and more accurate results. This paper comprehensively analyzes the most recent deep-learning techniques for COVID-19 diagnosis. According to research publications, convolutional Neural Networks (CNN) is the most popular deep learning techniques for COVID-19 identification from medical images. Pre-processing medical images is essential, transfer learning and data augmentation approaches can help with data scarcity issues, using pre-trained models can save time, and medical photos play a crucial part in the automatic detection of COVID-19. This article also gives young researchers a sane perspective on creating CNN models combined with medical imagery to detect diseases early.

Keywords: COVID-19 Detection, Image Processing, Deep Learning, CNN, X-ray Images, CT Images.

1. INTRODUCTION

The sickness known as the SARS-CoV-2 coronavirus brings on COVID-19. The World Health Organization (WHO) designated COVID-19 on February 11, 2020 (World Health Organization, 2020).¹ According to statistics from the World Health Organization as of June 2021, the sickness has spread to almost every country since the discovery of the first case and has already claimed the lives of over 4 million individuals among the roughly 180 million confirmed cases. Patients are screened in hospitals or primary care clinics as the initial step in the therapy of COVID-19.

Although transcription-polymerase chain reaction (PCR) testing is still mainly used for the ultimate diagnosis, medical imaging is currently the standard hospital protocol for patients with severe respiratory symptoms since it is quick and easy. However, at the moment, clinicians may encounter people in hospitals with pneumonia brought on simultaneously by the flu, other viruses, and COVID-19. Therefore, a rapid and precise detection method that can distinguish between the two types of pneumonia is required.

The diagnosis of COVID-19 frequently uses X-ray imaging methods because of their widespread availability, quick turnaround, and inexpensive cost. However, CT imaging methods are favored since they provide extensive information on the affected area. However, due to a lack of in-depth understanding of the illness, even for expert radiologists, identifying the infection from medical imaging has become complex. For the diagnosis of COVID-19, deep learning algorithms combined with medical imaging have proven to be a helpful option that produces quicker and more accurate findings. The primary purpose of the Convolutional Neural



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Network (CNN), a deep neural network used to detect COVID-19 from medical pictures, is pattern recognition.

This article aims to gather the methodology of recent studies on the automatic detection of COVID-19 from medical photos using deep learning algorithms. This essay compares the outstanding qualities of current deep learning techniques employing CT and X-ray imaging modalities. Models performed better when the datasets were enhanced, according to a study of models with and without data augmentation. Additionally, it gives young researchers a logical direction for creating CNN models that are incredibly effective when used with medical imagery to identify diseases early on. Several groups 14–16 have recently described COVID-19 pneumonia detection methods based on deep learning. Alshazly¹⁴ detected COVID-19 with accuracy, precision, and sensitivity of 93.96%, 99.13%, and 94%, respectively, using deep CNN architectures on CT-scan images. With a limited dataset of 339 appearances for training and testing, Ayrtou¹⁵ presented a deep transfer learning technique based on ResNet50 and obtained a validation accuracy of 96.2%. Wang¹⁶ suggested five pre-trained deep learning models, and the Xception model had an effect close to ideal and an accuracy of 96.75%.

2 Deep Learning and Medical Image Analysis: Challenges And Opportunities

This section first summarizes existing deep learning and medical image processing methods for COVID-19 imaging. Then, we discuss challenges and possible prospects for this field's future research.

The generalizability of trained models from data, encompassing both the over fitting problem and the out-of-distribution problem, is a broad, enduring challenge in machine learning and deep learning. In other words, if a deep understanding or machine learning model performs well on training data, such as medical photos, but poorly on test data, the learned model likely employs over fitting features. Additionally, the so-called out-of-distribution problem will arise if the known models are evaluated on data sets that are systematically dissimilar from the training and test data. The generalizability problem is complicated and prevalent in radiology and medical imaging. The generalizability difficulty has been addressed using various strategies, including transfer learning, domain adaptation, training, radiography, and imaging in healthcare.

Similarly, the generalizability problem has long been a problem in medical image analysis because different imaging facilities or hospitals could produce medical image data sets with other cofactors and characteristics for the same type of disease or condition. The difficulty of this problem has increased for COVID-19 imaging and diagnosis, and numerous studies have been suggested to solve it. For better COVID-19 diagnosis utilizing CT images, Liu & Ji proposed a multi-stage attentive transfer learning architecture. Their approach specifically comprises three stages to build precise diagnosis models by learning from several source tasks and data from various areas. They created a novel self-supervised learning technique to teach lung CT pictures multiscale representations.

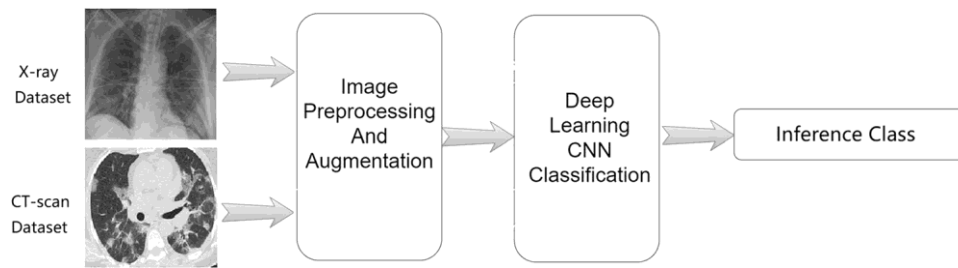


Fig 1. Deep Learning Based Screening Structure Of COVID-19.

Medical image analysis, notably the analysis of COVID-19 imaging data, has extensively used deep learning. It is also evident that deep learning is not being used in clinical radiology practices as quickly as was anticipated. One of the key causes is that radiologists and clinical physicians need more faith in and confidence in deep learning. Trust in a decision provided by deep learning, according to Xie et al., is based on a rationale that:

1. Simply understandable.
2. Relatable to the user.
3. Connects the decision with context regarding the choice or the user's prior experiences.
4. Reflects the user's intermediate thought process.

Despite its widespread appeal and effectiveness in solving many machine learning challenges, deep learning has many limits. First, deep learning models automatically learn representations from data, making them heavily reliant on data-driven learning paradigms. As a result, data-driven deep learning invariably results in known models that replicate or even amplify biases present in the data; this result has recently drawn much interest from the community. Many people have questioned the fairness of deep learning models in various application contexts, including medical imaging and COVID-19 imaging. These biases include prediction outcome discrimination and disparity in prediction quality. Second, as Poggio et al. noted, deep learning is still poorly understood theoretically, and many of its operations are regarded as black boxes.

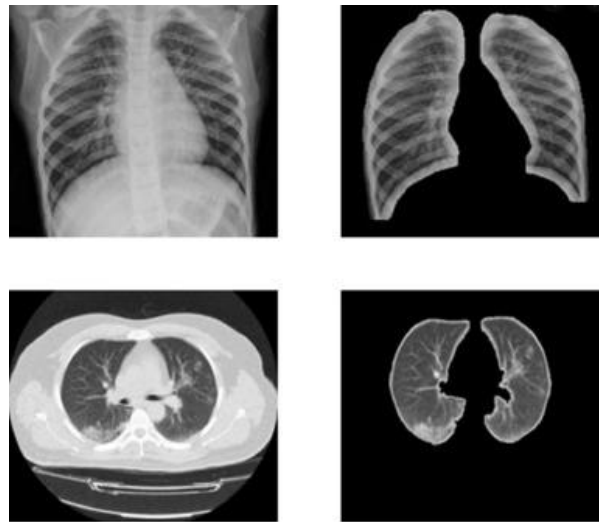
The most frequently used modalities in the clinical imaging-based diagnosis of COVID-19 are radiography and CT. The Fleischner Society advises radiography and computed tomography (CT) in various situations; for instance, chest radiography is recommended for COVID-19 patients in a resource-constrained setting with limited access to CT. In addition, the preferred imaging modalities for COVID-19 diagnosis vary geographically. For instance, in China, early hospital admission for diagnosis of COVID-19 patients was urged as a public health policy, and COVID-19 infection is more likely to be detected with CT than early chest radiography.

3 Pre-Processing

Medical imaging is taking pictures of a person's inside organs to diagnose various physical problems. X-ray and CT are the two most often used medical imaging modalities for identifying COVID-19. However, because of the images' low intensity and contrast, the boundaries and margins are not visible, which could result in a mistaken disease diagnosis. Therefore, to improve the model's accuracy, it is imperative to pre-process medical images to extract the pertinent information and discard the rest. Medical image processing involves applying an algorithm to a digital image to improve the image quality of the raw medical data for further analysis.

4 Segmentation

Image segmentation is an important image processing method to improve the accuracy and dependability of the model's predictions. The lung region serves as the Region of Interest (ROI) for COVID-19 detection during segmentation. Separating the lung region from other background information in the medical pictures minimizes computational complexity.



a) Lung Images

b) Segmented Lung Images

Fig 2. Image segmentation samples

4. Image enhancement

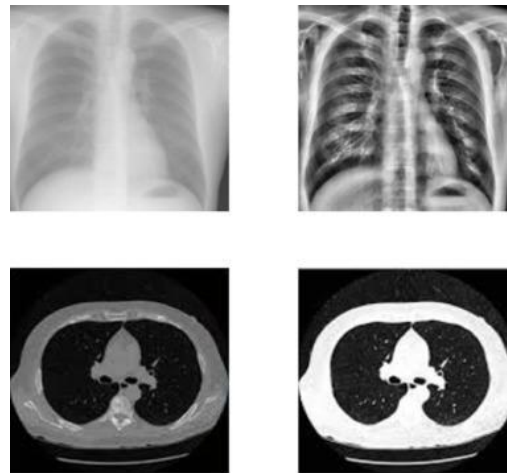
Image enhancement is crucial for improving medical images' visual perception quality for diagnosis of illness. Histogram equalization is an improvement method that evenly distributes the intensity level throughout the image's pixels. In some instances, the strong contrast in the white region causes the information carried by the white pixels to be washed out. The intensity values are only distributed across a limited image portion through adaptive histogram equalization (AHE). It can cause the noise in the homogenous zones to be overamped. Contrast Limited Adaptive Histogram Equalization, or CLAHE, reduces the over-emphasis of noise brought on by AHE. Setting a maximum contrast limit at which the contrast cannot be improved improves the image by preventing noise from being amplified excessively.



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a) Lung Images b) Enhanced Lung Images

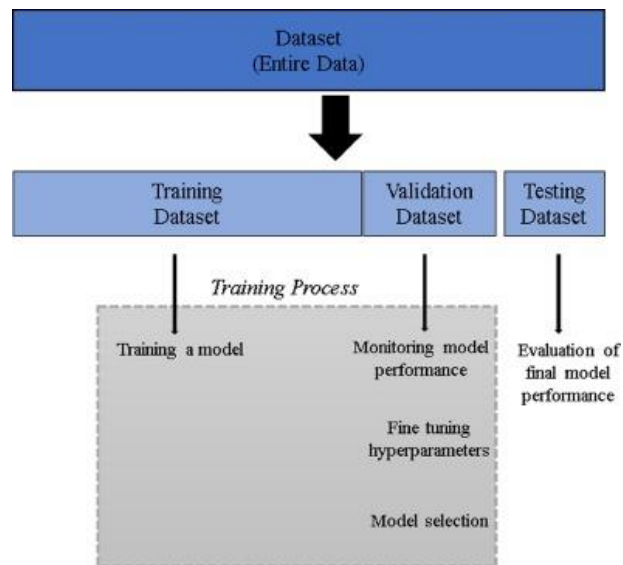
Fig 3. Image enhancement samples

5. Dataset

Deep learning requires a large amount of data for the model to be trained efficiently and accurately. The data available in the dataset are split into three sets:

- i) Training dataset
- ii) Validation dataset
- iii) Test dataset.

The training dataset is used during the learning process to train the model to perform tasks. The validation dataset is used to evaluate, fine-tune model hyper parameters during the training process and facilitates in optimizing model selection. The test dataset is used to assess the model once it is completely trained using the training and the validation dataset. As COVID-19 is an ongoing and new pandemic, the available datasets are insufficient and imbalanced to train the model effectively.



6. Training, Validation, and Testing Split

The training dataset was divided into two parts: 20% was used to validate the already-built model, and the remaining 80% was used to make the model. The test dataset was used to assess the created model's actual performance after training without exposing it to it. 80% of the training data was split into five subsets for fivefold cross-validation. Chest X-ray scan images were used in either the test or train sets, but not both, without lossy compression.

The dataset was divided into 80% training and 20% testing to validate the developed model. The test dataset was not provided to the model during training and was used to verify the generated model's actual performance with metrics. To do five-fold cross-validation, 80 percent of the training data were further separated into five subgroups, and one subgroup was used to validate the training model.

7. Role of Datasets in the Detection of Covid - 19

Two popular medical imaging modalities that are used to identify and assess the severity of an infection are X-ray and CT. Each type of medical imaging has benefits and drawbacks. Due to its wide availability, X-ray imaging is the most often used medical imaging method for diagnosing COVID-19. It can be processed using straightforward steps, which reduce the amount of time spent imaging and lessens the risk of the virus spreading. When compared to other medical imaging modalities, it is affordable. Compared to a CT scan, it is non-invasive and generates minimal radiation exposure. Despite its advantages, X-rays are less sensitive, which may lead to a false prediction of the disease with early and mild symptoms.



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a) Normal Cases



b) COVID-19 Positive Cases

On the other hand, CT scans offer reliable results since they are susceptible, include comprehensive information about the affected area, and are sensitive. The diagnosis of lung anomalies mostly depends on CT imaging. Since it is more trustworthy, it aids in the early detection of COVID-19. However, CT screening has limited use due to expensive costs, increased radiation doses, and resource limitations.

Sl.No	Article/Year	Advantages	Limitations	Computational Complexity
1	Matias Cam Arellano & Oscar E Ramos / 2020	<ul style="list-style-type: none"> The model provided distinctive features as it is already trained for the detection of various lung diseases. The class imbalance problem is dealt with using the weighted loss function. 	<ul style="list-style-type: none"> The model was trained with less amount of dataset. Class imbalance of dataset needs to be focussed. 	<ul style="list-style-type: none"> Computationally less expensive as only two layers were added on top of the pre-trained DenseNet 121.
2	Abhijit Bhattacharya et al / 2021	<ul style="list-style-type: none"> Only focussed on the lung region in the X-ray images to provide explicit categorization of images. Histogram equalization was used to enhance the low contrast X-ray images for prominent training of the CNN model. 	<ul style="list-style-type: none"> The number of images used to train the model is low. 	<ul style="list-style-type: none"> Out of the pre-trained used, DenseNet-201 took the highest time of 2298 seconds to train the model and the simple customized model (sCNN) took the lowest time of 200 seconds to train the model.
3	Khandaker Foysal Haque et al / 2020	<ul style="list-style-type: none"> The proposed sequential CNN model from scratch provided better accuracy when trained with the relevant medical dataset than the pre-trained models that are trained 	<ul style="list-style-type: none"> The model was trained with a limited dataset. 	<ul style="list-style-type: none"> Due to its simpler architecture, the model is computationally efficient.

Because there are more datasets available for X-ray pictures than other medical imaging types, numerous researchers have used them to train the CNN model to identify COVID-19. Sample X-ray pictures of a) Normal cases and b) COVID-19-positive cases from the COVID-19 dataset

are shown in Fig. 4. We briefly describe the application of deep learning approaches in recently suggested systems for detecting COVID-19 from X-rays.

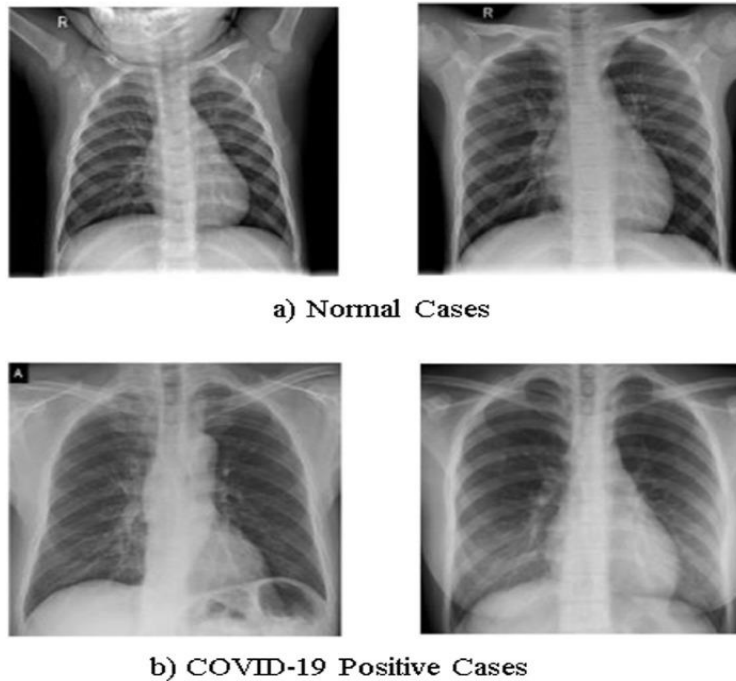


Fig 4. Sample X-ray images of a) Normal cases b) COVID-19 positive cases

The use of CT imaging in COVID-19 early detection is beneficial. It is used because it offers a three-dimensional image of the lung that includes specific information about the damaged area.

Sl.No	Article/Year	Advantages	Limitations	Computational Complexity
1	Xing Wu et al / 2020	<ul style="list-style-type: none"> The manual labeling cost of the dataset was reduced. A selected subset of CT scans was used to reduce the computational cost. Lung segmentation was done to minimize the system computation thereby increasing the accuracy. 	<ul style="list-style-type: none"> Requires a combination of clinical information with CT scans to generate more reliable outputs. 	<ul style="list-style-type: none"> Computational cost is reduced by the proper subset selection of CT scans.
2	Hayden Gunraj et al / 2020	<ul style="list-style-type: none"> The authors created the benchmark dataset COVIDx-CT. The proposed COVIDNet-CT is available as open-source to the general public. 	<ul style="list-style-type: none"> COVIDx-CT dataset needs to be expanded to improve the generalizability of the model. 	<ul style="list-style-type: none"> Computational complexity is minimized by the usage of micro-architecture designs.

The use of CT imaging in COVID-19 early detection is beneficial. It is used because it offers a three-dimensional image of the lung that includes specific information about the damaged area.

The sample CT images of a) Normal patients are shown in Fig. 5. b) Cases from the COVID-19 dataset that were COVID-19 positive. CT scanning is the imaging approach employed by some recently suggested deep learning methods, which is briefly discussed.

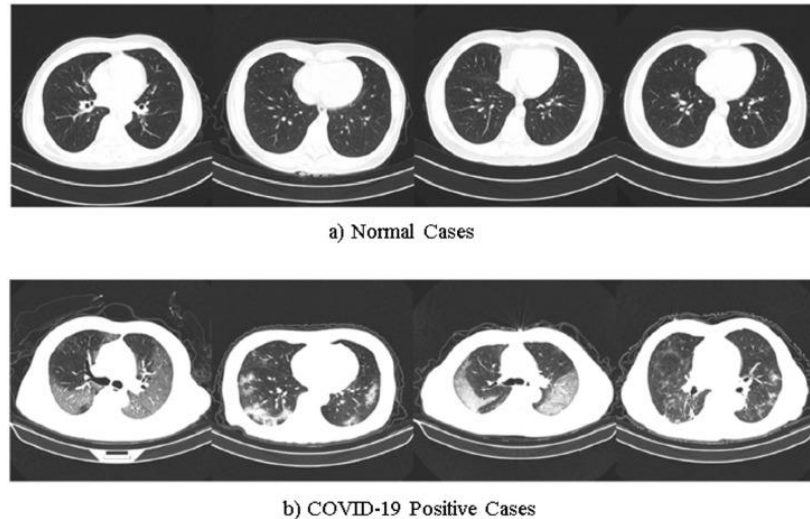


Fig. 5. Sample CT images of a) Normal cases b) COVID-19 positive cases

4. CONCLUSIONS

The role of the two medical imaging techniques X-rays and CT, in the detection of COVID-19, is described briefly. Though X-ray imaging is simple, less expensive, and widely available, CT imaging is highly sensitive in predicting the severity of the disease. Due to the X-ray image dataset's wide availability compared to the CT image dataset, most researchers have utilized chest X-ray images to detect COVID-19. A comparison has been made for the state-of-the-art methods that could guide young researchers to find future direction. Models proposed for binary and multiclass classification are studied, and observed that the models produced better accuracy for binary classification than multiclass classification. Accuracy, Specificity, Precision, Recall, F1-score, ROC curve (Receiver Operator Characteristic), and AUC (Area Under the Curve) are the standard metrics to evaluate the model's performance.

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COMPARATIVE STUDY OF PERFORMANCE EVALUATION OF FLOW OVER CRUMP WEIR USING DATA-DRIVEN MODELS

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ABSTRACT

The flow characteristics changes with varying geometry of hydraulic weir and how the weir is inclined to the direction of flow in a channel. In this way, several studies have investigated the performance weirs experimental with paying much attention on the accurate prediction of discharge coefficient. Thus, the main objective of this study is to employ artificial intelligence (AI) techniques to predict discharge coefficient (C_d) of crump weir models. Hence, the precision and use of seven data-driven models including Bayesian neural network (BNN), multiple linear regression (MLR), multi-layer perceptron neural network (MLPNN), genetic algorithm (GA), support vector machine (SVM), Radial Basis Function (RBF) and curve fitting neural network (CFNN) were examined for estimating of the C_d . To achieve this, experiments were conducted on eighteen crump weir models of different apex angles 80° , 90° , 100° , 110° , 120° and 130° . The upstream angles of the weir models were set in decreasing order of 85° , 70° , 55° , 40° , 25° and 10° . While the downstream angles were increased as 15° , 20° , 25° , 30° , 35° and 40° respectively. 360 laboratory test results were used, 70% for training, 15% for testing and 15% for validation. And statistical parameters of coefficient of determination (R^2), root-mean-square error (RMSE), mean absolute error (MAE), were employed as the criteria for the comparison of the models' performance. Results showed good agreements between the observed and estimated



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values using the AI-based models. However, among these models, the CFNN managed to estimate the C_d of the weir with the highest precision and accuracy than the rest of the models with ($RMSE=0.1635 \times 10^{-4}$, $R^2=0.9981$). Also, it was found that the most efficient crump was weir model 17 for having the least C_d of 1.14914 and least percentage error of 12.97412, which has been optimized using GA with C_d value of 1.14815.

Keywords: Crump Weir, Discharge Coefficient, Channel, Experiments, Artificial Intelligence.

1. INTRODUCTION

The Crump section *flat-vee* weir is favored by hydrometrics because of the accuracy and range of flow measurement it exhibited. It is comparatively insensitive to submerged conditions and ease of determination of flow curves for any width, and its coefficient of discharges remain through undrown condition. However, this type of weir is disliked by fishermen because it can present a barrier to migration of fish (Rickard *et.al.*2003). As such it becomes necessary to investigate the behavior of the flow over the crump weir. In this way, few studies have been devoted to evaluating the flow over crump weirs, for example, Bos,1989 was the first to study the flow characteristics of trapezoidal profile weirs systematically. He conducted a series of experiments on these types of weirs with both upstream and downstream side slopes. The discharge coefficient was determined for free flow conditions using different discharge values. Also, Al-Naely *et al.*, 2018 placed crump weirs in a channel as a control device in order to the flow rate, a new performance for the crump weirs was observed as a result of adding an opening holes in the model of crump weir. The opening holes act as energy dissipaters and improves for the discharge coefficient (C_d), where higher values of the discharge coefficient (C_d) were recorded in comparison with conventional weir under the same laboratory conditions. In the same vein, the creation of an opening in a broad-crested weir was found to increase the discharge coefficient and consequently improving the discharge (Daneshfaraz et al. 2019). Similarly, Khalifa & Umar, 2018 conducted experiments on crump weir models of different apex angles, they demonstrated that increase in the apex angle resulted in decrease in discharge coefficient. Hence, controlling the amount of discharge over different hydraulic structures was always a field of interest for researchers, with a view of decreasing sedimentation in reservoirs (Zahabi et al., 2018).

2. THEORETICAL BACKGROUND

2.1. Governing Equations

The discharge was estimated using the equation governing the modelling of flow over crump weir by determining the upstream flow head (h). Point gauge was used to measure the, h , above the crump weir (Arora, 2005). Thus, for modular flow over the crump weir, when the weir operates undrowned, the modular discharge is expressed as follows:

$$Q_m = C_d \sqrt{g} \cdot b H_o^{\frac{3}{2}} \quad (1)$$

C_d and H_o can be determined using Equations (2) and (3) respectively

$$C_d = 1.163 \left(1 - \frac{0.0003}{h} \right)^{1.5} \quad (2)$$

$$H_o = y_o + \frac{v_o^2}{2g} \quad (3)$$



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Where, Q_m = Discharge for modular flow (m^3/s), C_d = Modular discharge coefficient, g = gravity (m^2/s), b = Breadth of weir (m), H_o = Total head upstream of the weir crest (m), y_o = upstream water level (m), $\frac{V_o^2}{2g}$ = upstream velocity head (m).

However, for non-modular flow, when the weir operates drowned, a single measurement of upstream head is not sufficient to calculate the actual flow as the upstream head is affected by changes in the downstream head. In this case, a dimensionless reduction factor is introduced to correct the non-modular flow as given by Equation (4):

$$f = Q/Q_m \tag{4}$$

Where, Q = Discharge for non-modular flow (m^3/s)

2.2 Artificial Neural Networks

Artificial neural network (ANN) is a nonlinear mathematical model that is able to simulate arbitrarily complex nonlinear processes, which relate inputs and outputs of any system. In many complex mathematical problems that lead to solving complex nonlinear equations, multilayer perceptron networks are common types of ANN widely used by researchers (Parsaie 2016; Moazamnia et al. 2019).

2.3 Support Vector Machines

Support vector machines operate based on data mining algorithms and are like other artificial intelligent methods. It was used in different fields of hydrology (e.g., Nadiri et al. 2017) and Hydraulics (e.g., Sadeghfam et al. 2019). Support vector machines are an efficient learning system based on the theory of optimization that uses the inductive principle of minimization of structural errors and lead to a general optimal response.

2.4 Multi-layer Perceptron Neural Network (MLPNN)

MLPNN is a computational method which tries to propose a mapping between input space (input layer) and optimal space (output layer) by understanding the inherent relationships among data with the help of learning process and using simple processors called neurons (Heidari *et al.*, 2016). The high speed of processing and flexibility in the face of unwanted errors are the features of this model. Its main advantage is its high speed and optimal precision in the prediction of complex variables with linear and non-linear mapping.

2.5 Multiple Linear Regression (MLR)

MLR is the most common regression which is employed to create a linear relationship between a dependent variable such as y and a set of independent variables such as $x_1, x_2, x_3, \dots, x_n$ [J.P. Resop, 2006]. The linear equation of this method is in the form of Equation (3.10).

$$y = +b_0 + b_1 x_1 + b_2 x_2 + \dots \tag{3.10}$$

. The performance and precision of regression methods highly depend on the sample size, and sample size can limit statistical models [Ghorbani et al, 2017].

2.6 Multilayer Perceptron (MLP)

Multilayer perceptron (MLP) network is the most commonly used neural network model applied in water engineering issues; for training, this network, a back-propagation learning algorithm which is a learning method with an observer, is used. The purpose of training a neural

network is to arrange the network parameters (weights and biases) by providing training patterns, in a way that by representing the same patterns, the resulted error between the optimal response and network is minimized.

Mohammad Zounemat *et al.*, 2019 have examined the precision and use of six data driven models including BNN, MLR, MLPNN, GEP, LSSVM and CHAID for estimation of discharge passing triangular Arced labyrinth weir. MLPNN managed to estimate the discharge passing the weir with the highest precision (RMSE = 0.00385, $R^2 = 0.999$).

Reza Norouzi *et al.*, 2019 have investigated the performance of MLP, RBF and SVM in predicting the discharge coefficient (C_d) of lybrinth weirs. The performance of the MLP model was excellent with RMSE and R^2 of 0.019 and 0.985 respectively.

In the studies of Zounemat *et al.*, 2019, they applied various hybrid meta-heuristic MLPNN and ANFIS for predicting flow parameters of piano key weir flow.

3. METHODOLOGY

3.1 Fabrication of the Experimental Models

The experimental work was conducted on eighteen crump weir models of different apex angles of 80° , 90° , 100° , 110° , 120° and 130° . Accordingly, the upstream angles of the models were decreased to have the following values 85° , 70° , 55° , 40° , 25° and 10° , and to as well increasing the downstream angles as 15° , 20° , 25° , 30° , 35° and 40° respectively, which will sum up to give 180° as the total angles in a triangle as shown in Figure 1. Plywood of 22 mm thickness was used in fabricating the main body of the crump weirs.

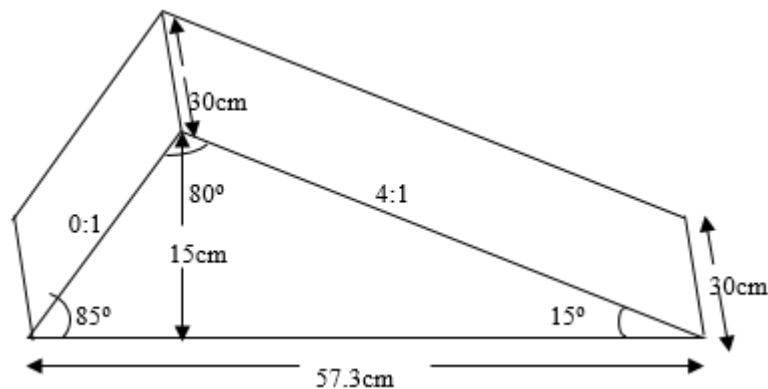


Figure 1: The schematic view of crump weir model 1 of apex angle 80° , upstream angle and slope, 85° and 0:1, downstream angle and slope, 15° and 4:1 respectively.

Table 1. Geometric factors of crump weir models

Model	Upstream Slope	Downstream Slope	Model width 'b' (cm)	Crest Height 'P' (cm)	Apex Angle (degree)	Upstream Angle(degree)	Downstream Angle(degree)
1	0.1:1	4:1	30	15	80	85	15
2	0.4:1	3:1	30	15	90	70	20
3	0.7:1	2:1	30	15	100	55	25



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4	1:1	2:1	30	15	110	40	30
5	2:1	1:1	30	15	120	25	35
6	6:1	1:1	30	15	130	10	40

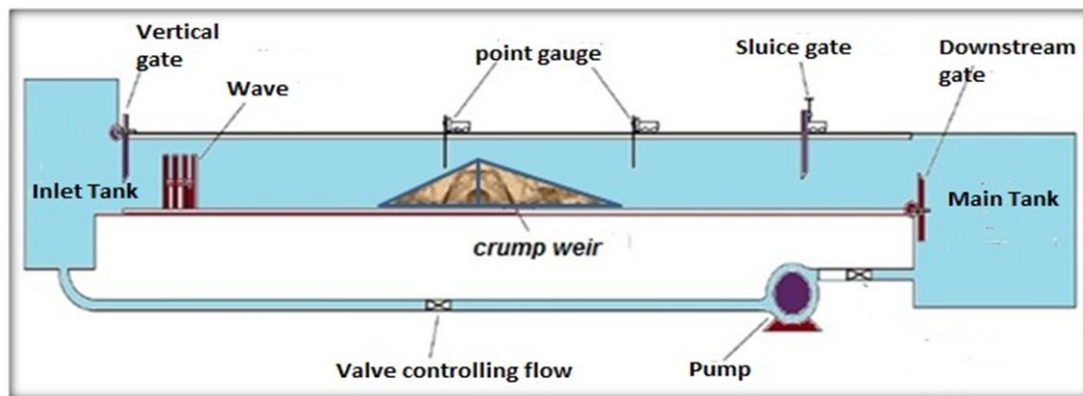


Figure 2: Sketch of crump weir model and experimental flume.

3.2 Experimental Procedure:

The crump weirs were installed in the flume with the help of sealants to prevent leakage, which has to be levelled. One vernier were located downstream the weir and the other upstream. The verniers were zeroed with the bed of the channel.

Seventy-two models were fabricated for which the angles were varied, 80°, 90°, 100°, 110°, 120°, and 130°

Experiment were then be ran for each model and various heads and their corresponding discharges were recorded; The procedure has five (5) runs. Each run has a different flow rate and a set of four (4) y_o and y_l depths; two sets for modular flow condition and the other two sets for non-modular flow condition. The initial flow rate were set. Then, y_o and y_l depths were recorded for the following conditions: Modular flow: without stop block (gate). Modular flow: one full stop block (gate) (y_l should be the only depth that changes). Non-modular flow: Add a half of one stop block (gate). (y_l and y_o depth that change). Non-modular flow: Add one quarter of a stop block (gate). The flow rate were increased at constant interval.

Modular Flow

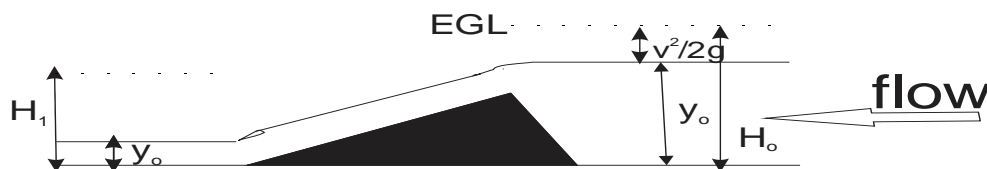


Figure 5. Crump weir during modular flow condition

Non-Modular Flow

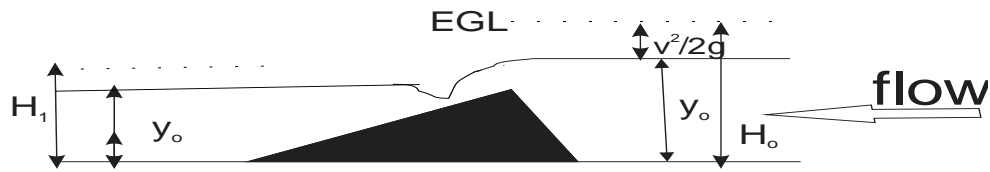


Figure 6. Crump weir during non-modular flow condition

Heights ($P=10\text{cm}$, 15cm , 20cm) were used as a crump weir models. For each type of crump three types of surface roughness were used. The first one were a smooth PVC, the second one is coated with a uniform sand $D_{50}=0.72\text{ mm}$ (D_{50} is the sieve diameter in which 50% of material are finer), while the third is covered by gravel of $D_{50}=3.6\text{ mm}$. Eighteen models were used to conduct the experimental study. In each run the selected model were inserted along the width of the flume. Then the pump started at desired flow rate and after the flow stability were achieved the water surface level upstream and above the weir model were measured using point gauge. For each type of the crump weir a series of tests under different flow rates were conducted. The pump were activated and the discharge were adjusted using a control valve and the reading of the point gauge were recorded to give the head above crump weir required for the calculation of estimated discharge; At the beginning of each run the control valve were adjusted to alter the head; For each head recorded, the actual discharge were measured by direct method using the weighing arrangement provided at the tail end of the flume. The previous steps were repeated for each of the five runs of experiments to be conducted for each model. A total of 360 runs were conducted.

3.3 Determination of Observed Discharge (Q_o)

The observed discharge, Q_o , was measured experimentally using the gravimetric method. Throughout the experiment, 100kg of water were collected by means of the weighing balance (see plate II) attached to the flume and stopwatch was used to obtain the time taken to collect the 100kg for onward determination of discharge.

Volume, $V = \text{mass}/\text{density}$

Observed discharge, $Q_o = \text{Volume} / \text{average time}$

$$\text{Average time} = \frac{(t_1 + t_2)}{2} \quad (5)$$

3.4 Determination of Estimated Discharge (Q_e)

The discharge equation for the crump weir was used to compute the estimated discharge using the flow heads.

Point gauge will be used to measure the flow head (h) above the crump weir (Arora, 2005).

$$Q_m = C_d \sqrt{g} \cdot b H_o^{\frac{3}{2}} \quad (1)$$

$$C_d = 1.163 \left(1 - \frac{0.0003}{h} \right)^{1.5} \quad (2)$$

$$H = y + \frac{v^2}{2g} \quad (3)$$



3.6 Derivation of Discharge Coefficient

In order to validate the suitability of the theoretical equations, the maximum of the absolute value of the deviation of the data from the model was obtained as:

$$\text{MaxErr} = \max(\text{abs}(C_{do} - C_{de})) \quad (7)$$

Where, C_{do} = Experimental Discharge Coefficient = Q_o / Q_e

C_{de} = Estimated Discharge Coefficient

$$Cd = (D_{50}, P, h, Q, \theta) \quad (8)$$

Thus, by dimensional analysis and using the approach of Buckingham's π -theorem, Equation (8) becomes:

$$Cd = f\left(\frac{D_{50}}{P}\theta, \frac{h}{P}\right) \quad (9)$$

It follows that Equation (9) can be expressed as Equation (10) based on dimensional homogeneity:

$$C_d = k_1 \left[\frac{D_{50}\theta}{P}\right]^a + k_2 \left[\frac{h}{P}\right]^b \quad (10)$$

Where, K_1 , K_2 , a , and b are parameters to be estimated by regression analysis.

4. RESULTS AND DISCUSSION

4.1 Computation of Discharge Coefficients (C_d)

Tables 2 show the values of C_d obtained from Equations 1 and 2 respectively. The head measurements were obtained by means of the point gauge.

Table 2a. Discharge characteristics for model 1:

$Q_o=V/t/m^3/s$	y_o/m	$h_o=y_o - 0.10/m$	y_1/m	H_o/m	H_1/m	C_d	$Q_e/m^3/s$	% Error
0.001515	0.120	0.020	0.060	0.121	0.065	1.13693	0.00133	12.04391
0.001563	0.160	0.060	0.110	0.175	0.115	1.15429	0.00135	13.36654
0.001613	0.194	0.094	0.135	0.210	0.140	1.15744	0.00139	13.60220
0.001667	0.210	0.110	0.130	0.228	0.150	1.15825	0.00144	13.66252
0.001724	0.218	0.118	0.100	0.235	0.160	1.15857	0.00149	13.68652
Average						1.15310	0.001400	13.27234

Table 2b. Estimated discharge and C_d for PVC

$Q_o=V/t/m^3/s$	y_o/m	$h_o=y_o - 0.10/m$	y_1/m	H_o/m	H_1/m	C_d	$Q_e/m^3/s$	% Error
0.00150	0.125	0.025	0.060	0.130	0.060	1.14213	0.00131	12.44421
0.00158	0.167	0.067	0.100	0.177	0.110	1.15520	0.00136	13.43472
0.00164	0.193	0.093	0.120	0.208	0.140	1.15738	0.00142	13.59774
0.00170	0.208	0.108	0.060	0.227	0.150	1.15816	0.00146	13.65596



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0.00175	0.215	0.115	0.060	0.232	0.150	1.15845	0.00151	13.67792	
Average							1.15426	0.001412	13.36211

Table 3. Summary of models performance based on Cd and Percentage Error

Model Number	Cd Average	Percentage Error	Ranking
17	1.14914	12.97412	1
2	1.15189	13.17617	2
8	1.15122	13.18413	3
16	1.15223	13.20521	4
4	1.15313	13.27629	5
15	1.15383	13.32875	6
5	1.15406	13.34741	7
7	1.15414	13.35236	8
1	1.15425	13.36062	9
11	1.15425	13.36155	10
10	1.15433	13.36725	11
13	1.1544	13.37097	12
3	1.15449	13.37998	13
14	1.15476	13.39963	14
9	1.15483	13.40455	15
12	1.15527	13.43799	16
18	1.15546	13.4523	17
6	1.15553	13.45773	18

Table 4. Summary of the statistical analysis of Cd predicted by MLP using different neurons.

No of neurons	Training		Validation		Testing	
	MSE _x (10 ⁻⁶)	R ²	MSE _x (10 ⁻⁶)	R ²	MSE _x (10 ⁻⁶)	R ²
1	9.0141	0.9123	7.5607	0.9152	4.5334	0.9613
2	5.0244	0.9392	5.8012	0.9301	23.735	0.8881
3	8.6095	0.9116	6.2662	0.9356	6.7934	0.9419
4	7.5581	0.9154	7.8690	0.9376	7.0532	0.9386
5	8.1319	0.9172	7.4021	0.9139	25.307	0.8497
6	7.7184	0.9283	6.2652	0.9111	7.1875	0.9115
7	1.9925	0.7902	2.4047	0.6565	17.668	0.8180
8	9.0060	0.8856	5.1653	0.7087	16.042	0.8045
9	8.1825	0.9234	7.0573	0.9161	1.8738	0.9821
10	8.1417	0.9251	4.6387	0.9309	6.2766	0.9290
11	1.0583	0.9090	3.7310	0.9579	7.0051	0.9331
12	4.3199	0.9458	2.1757	0.8691	7.2633	0.9435
13	7.8978	0.9175	6.1824	0.9432	6.5836	0.9363
14	9.4249	0.9035	8.5379	0.9214	6.3073	0.9325
15	4.7196	0.9475	4.2265	0.9404	23.272	0.8592
16	9.1488	0.9180	5.5131	0.8933	8.6496	0.9166
17	7.7760	0.9240	8.3009	0.9161	5.6503	0.9328
18	3.9774	0.9525	2.2298	0.8719	189.13	0.5615

19	8.3764	0.9227	7.4020	0.9137	0.9750	0.8849
20	1.0319	0.9037	6.4052	0.9190	7.6421	0.9132

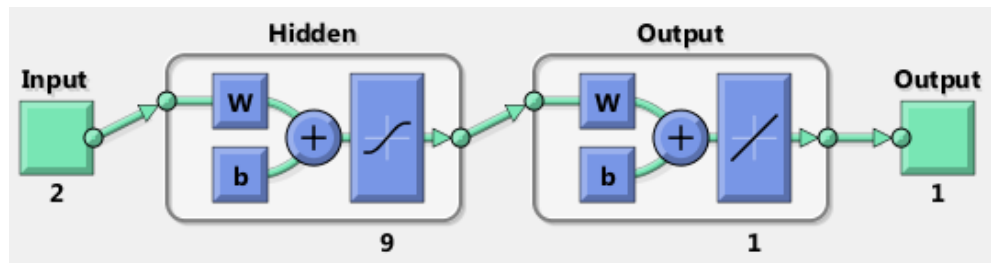


Figure 7. MLP Levenberg Marquardt neural network diagram

4.2 Discussion of Result:

Variation of Cd with (h/P)

The dimensional analysis for the variables affecting Cd value of weirs shows that the value (h/p) (Where h is head of the water on the weir, P height of the weir), has a greatest influence on Cd value. The calculated values of h/P are plotted against the Cd values for each weir and for each surface roughness's as shown in Figure 9. The figure shows that Cd value increase with increasing in h/P values for all the cases. Also it's evident from these figures that the gradient of the curve fit the points are decrease with increase in weir height, this means that the effect of h/P on Cd values will increase with increase in weir height.

Predicting the Cd of crump weir using ANN

Results of evaluating the precision of the data-driven models in the estimation of Cd of crump weirs in the training and testing sets are presented in Tables 5 and 6 respectively. Comparison of the values provided in Table 6 shows that CFNN managed to estimate discharge passing the weir with the highest accuracy (RMSE= 0.1635×10^{-6} MAE= 0.4713×10^{-3} $R^2 = 0.9981$). Also, CFNN was followed by MLPNN, BNN, GA, MLR, RBF and SVM.

Eqs. (15) demonstrate the extracted relationships between independent and dependent variables in the CFNN model. Scatter plots presented in Figs. 14 and 15 show the results of BNN and MLPNN respectively indicating their good precision in estimating the performance of the crump weir.

In this study, the precision of seven data-driven models was evaluated for the estimation of Cd for crump weir. Final results showed that CFNN could estimate the discharge passing the weir with the highest precision. Also, due to the effect of input parameters of the model on the estimation accuracy, CFNN precision was evaluated using the various combination of the input parameters. 2 different independent variables were used for constructing the applied models. In order to investigate the importance of each variable in the final performance of the models.

Table 7 shows the sensitivity analysis of Coefficient of discharge, Cd. The sensitivity analysis was carried, in order to evaluate the significance of input variables on the Coefficient of discharge. The sensitivity analysis was performed using the ANN model due to the high value of correlation coefficient and minimum error it produced.



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Consequently, the parameter ($\frac{h}{P}$) was found to be the most effective parameter with $R = 0.9971$, $MSE = 3.8513 \times 10^{-4}$ on the prediction of Cd. While the function ($\frac{D_{50}\theta}{P}$) was found to be the least effective parameter on the prediction of Cd.

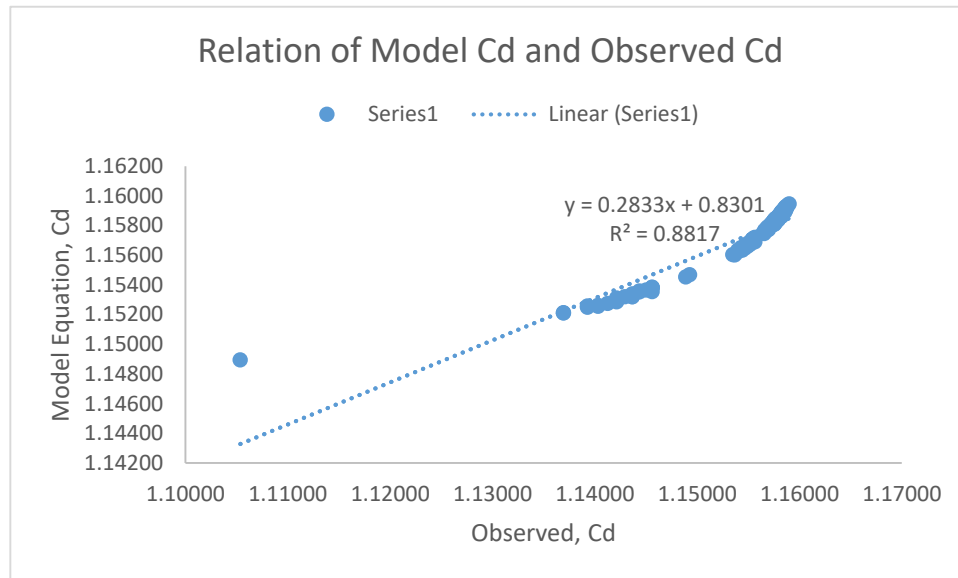


Figure 8. ANN verification of Cd from model equation

Table 5. Results of evaluating the performance of data driven models in the training phase.

Models	MSE $\times(10^{-6})$	MAE $\times(10^{-3})$	R ²
MLP	8.1825	0.9874	0.9234
BNN	7.9003	0.8452	0.9192
RBF	2897.6	1.7652	0.8400
SVM	4232.7	2.6745	0.7300

Table 6. Results of evaluating the performance of all the applied models in the testing phase.

Models	MSE $\times(10^{-6})$	MAE $\times(10^{-3})$	R ²
CFNN	0.1635	0.4713	0.9981
MLP	1.8738	0.6704	0.9821
BNN	3.4682	0.7461	0.9669
GA	3.9641	0.8452	0.9573
MLR	2611.7	1.4233	0.8700
RBF	2672.6	1.5712	0.8600
SVM	3288.7	2.1005	0.7900

Finally, the precision of the models in estimating the discharge passing the weir was evaluated using the root-mean square error (RMSE), mean absolute percentage error (MAE), R² (coefficient of determination). The best values of these criteria were 0, 0, and 1 respectively.



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$$RMSE = \sqrt{\frac{1}{n} \sum_{j=1}^n (y_j - \hat{y}_j)^2} \quad (12)$$

$$MAE = \frac{1}{n} \sum_{j=1}^n |y_j - \hat{y}_j| \quad (13)$$

$$\hat{R}^2 = 1 - \frac{\sum_{i=1}^n (Y_i - \hat{Y}_i)^2}{\sum_{i=1}^n (Y_i - \bar{Y})^2} = 1 - \frac{\frac{1}{n} \sum_{i=1}^n (Y_i - \hat{Y}_i)^2}{\frac{1}{n} \sum_{i=1}^n (Y_i - \bar{Y})^2} \quad (14)$$

In Eqs. (12)–(14), y is the actual Cd, \hat{y} is their average, n is the number of estimations.

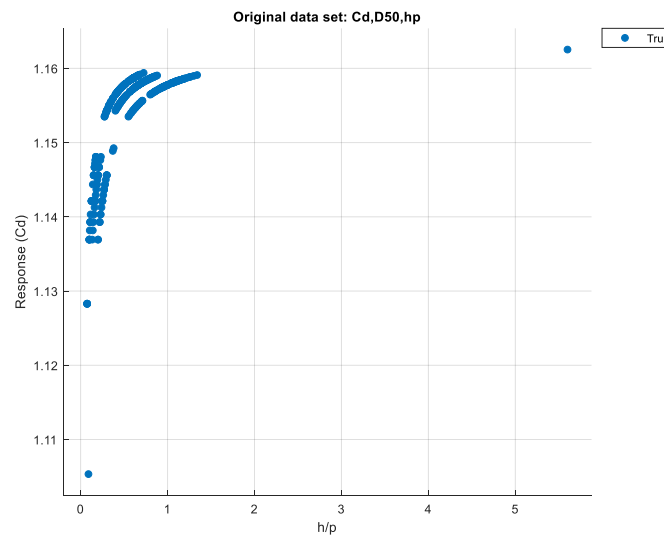


Figure 9. Relation of Cd and h/p using (MLR) model

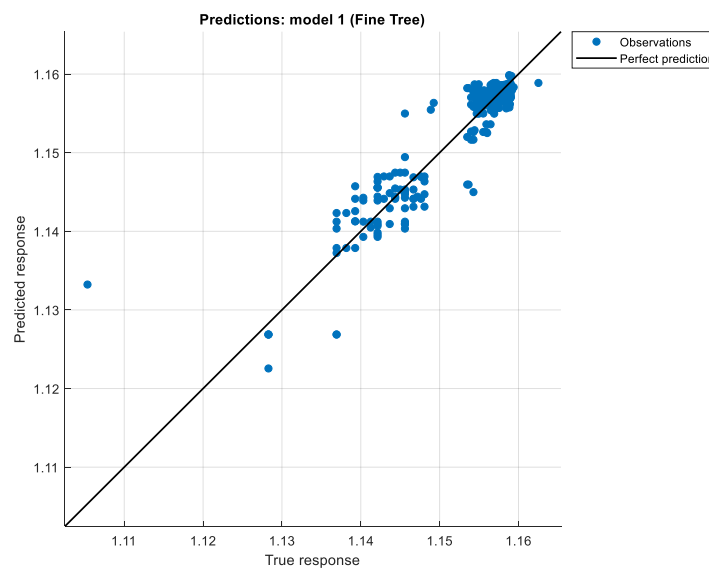


Figure 10. Relation of Cd predicted and Actual value using (MLR) model



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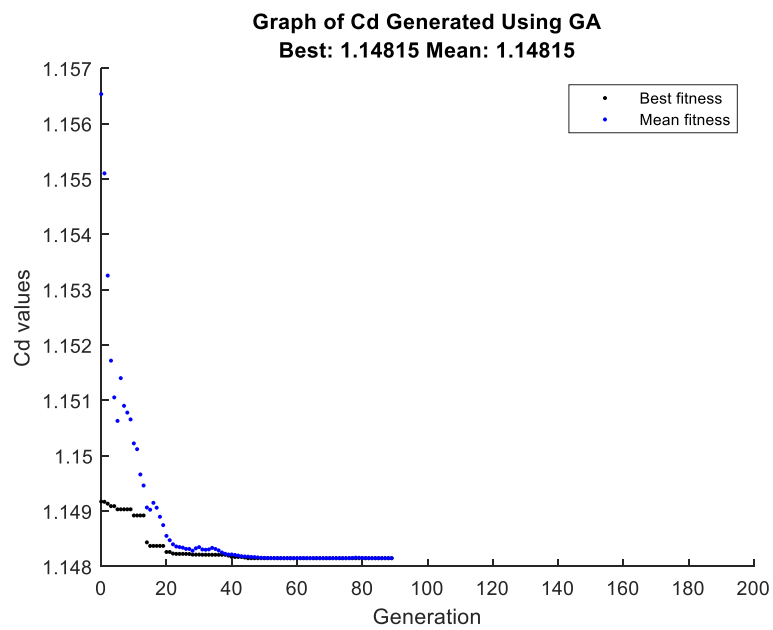


Figure 11: Relation of Cd generated using Genetic Algorithm (GA) model

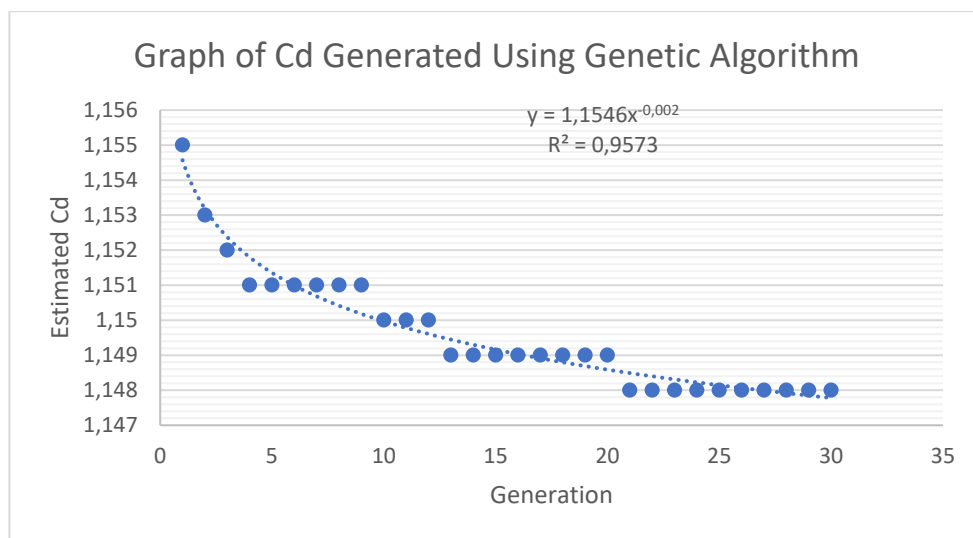


Figure 12. Relation of Cd Generated using Genetic Algorithm (GA) model



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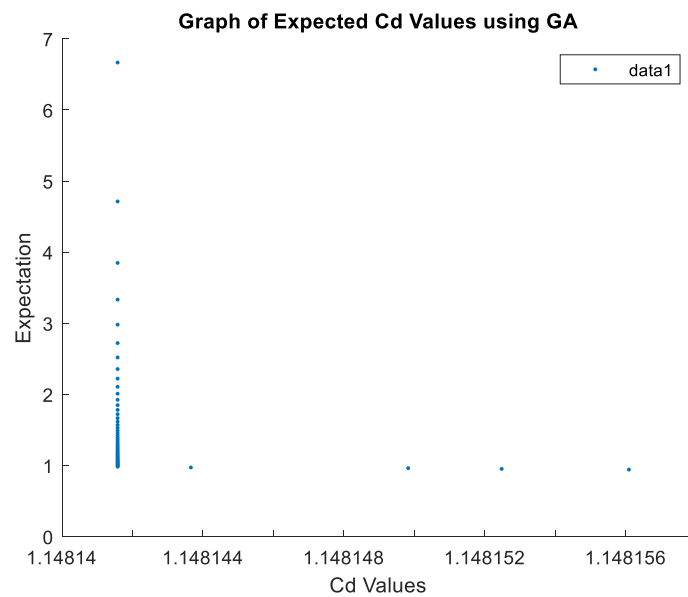


Figure 13. Relation of expected Cd fitness value using Genetic Algorithm(GA) model

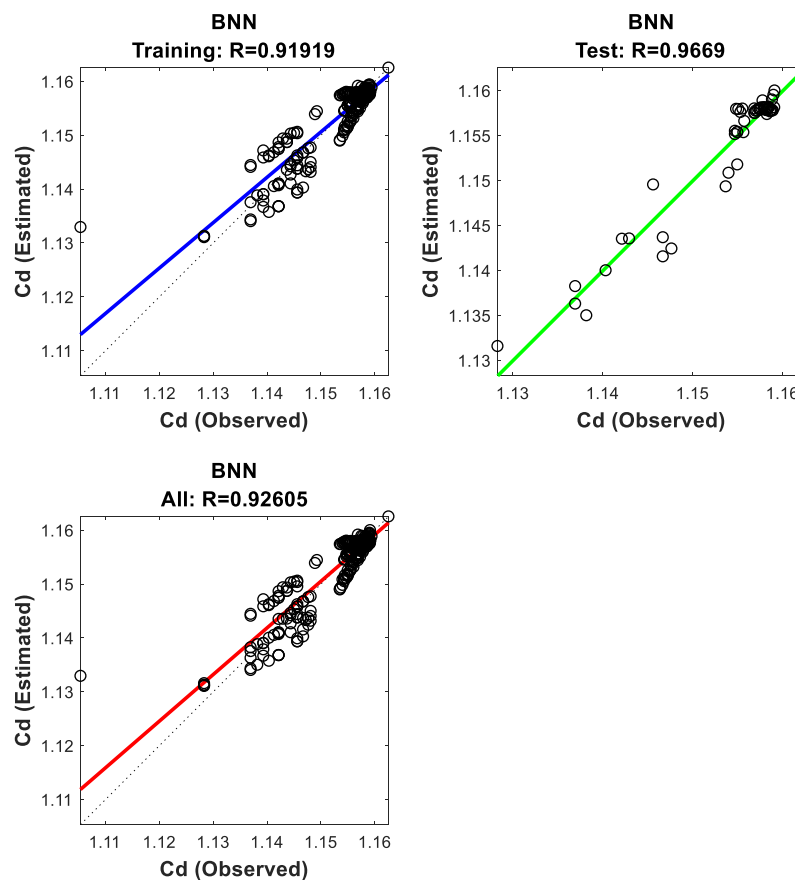


Figure 14. Distribution diagram of the observational-computational values in training and testing stages of Bayesian Neural Network (BNN) Model varification of Cd.



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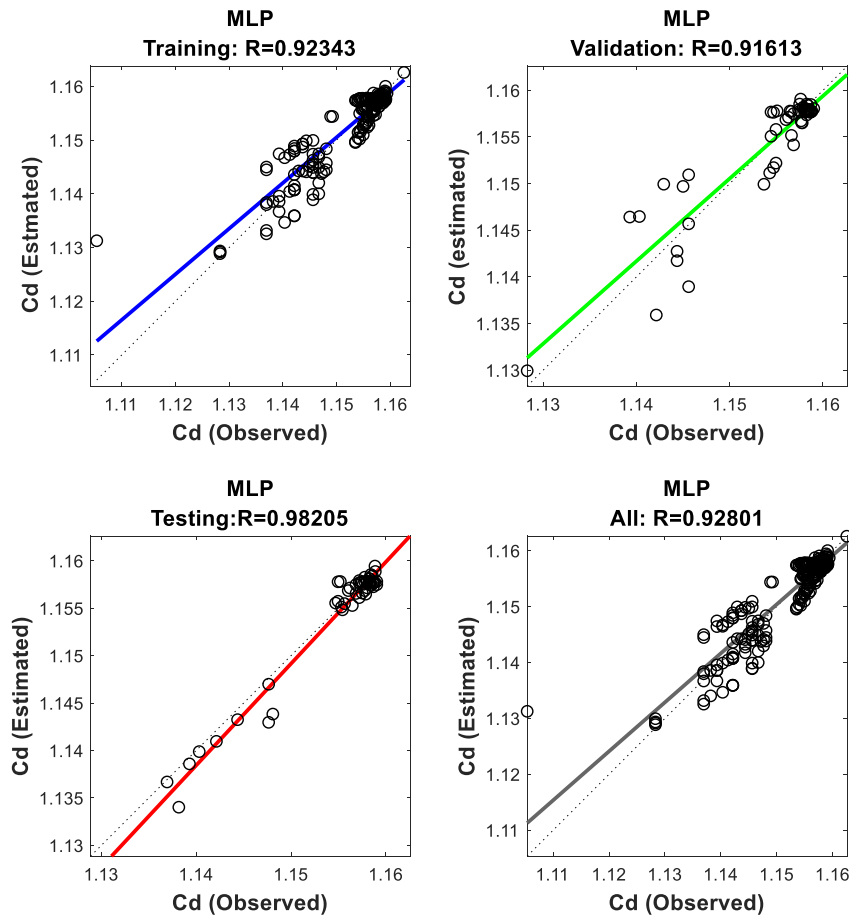


Figure 15. Distribution diagram of the observational-computational values in training and testing stages of MLP model

Thus, the parameters K_1 , K_2 , a and b in Equation (10) were determined through regression analysis and Curve Fitting Neural Network as expressed by Equation (15) as follows:

$$Cd = 0.5785 \left[\frac{D_{50}\theta}{P} \right]^{6.593 \times 10^{-5}} + 0.58 \left[\frac{h}{P} \right]^{0.006761} \quad (15)$$

The model equation has $R^2 = 0.9981$.

Table 7. Sensitivity analysis of Cd's for input parameters with ANN model.

Function	Training		Testing	
	MSE $\times (10^{-4})$	R^2	MSE $\times (10^{-4})$	R^2
$Cd = \left[\frac{D_{50}\theta}{P} \right]$	7.5421	0.9782	7.6801	0.9884
$Cd = \left[\frac{h}{P} \right]$	3.7313	0.9841	3.8513	0.9971



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$$Cd = \left(\frac{D_{50}}{P} \theta, \frac{h}{P} \right) \quad 0.1534 \quad 0.9883 \quad 0.1635 \quad 0.9981$$

Table 7 shows the sensitivity analysis of Coefficient of discharge, Cd. The sensitivity analysis was carried, in order to evaluate the significance of input variables on the Coefficient of discharge. The sensitivity analysis was performed using the ANN model due to the high value of correlation coefficient and minimum error it produced.

Consequently, the parameter $\left(\frac{h}{P} \right)$ was found to be the most effective parameter with R = 0.9971, MSE = 3.8513×10^{-4} on the prediction of Cd. While the function $\left(\frac{D_{50}\theta}{P} \right)$ was found to be the least effective parameter on the prediction of Cd.

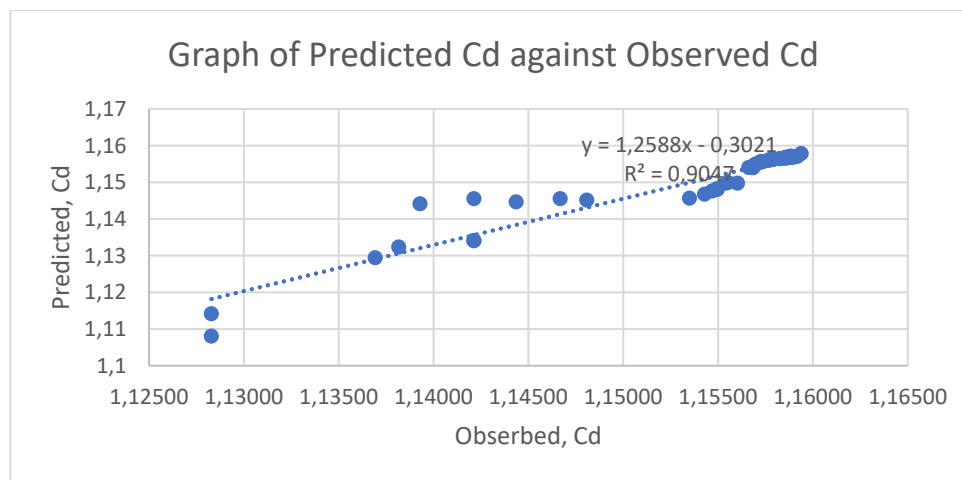


Figure 16. Relation of predicted Cd and observed Cd using (MLP) model

5. CONCLUSION and RECOMMENDATIONS

By using the equations which have been discussed in the literature, the raw data was calculated and processed using ANN.

Based on the results of the investigation, the following conclusions are reached:

1. Cd increases with the increasing flow rate.
2. The effect of h/P on Cd values increases with the increase in weir height. .
3. The effect of the increase of surface roughness on h values will be more on small heights of the crump weir than large ones.
4. Cd decreases from model 1 to model 18 with model 17 having the least Cd close to unity and least percentage error making model 17 to be more efficient.
5. Cd is dependent on the upstream angle, apex angle and downstream angle of the weir. As the upstream angle decreases from 85° to 10°, apex angle increases from 80° to 130° and the downstream angle increases from 15° to 40° the Cd decreases.
6. The Mathematical Model equation generated using CFNN performed better than other models such as MLP, BNN, GA, MLR, RBF and SVM with RMSE= 0.1635×10^{-6} MAE= 0.4713×10^{-3} R²=0.9981



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7. The model was optimised using GA and the predicted Cd value was 1.14815 as best fitted value.

The recommendations below are some of the improvements that can be carried out for further study:

1. Depth of weir and width of channel in variable value are suggested to get the best flow rate for hydraulic structure of crump weir design.
2. Calibration device for better data collection suggested using a volume meter to get the flow rate over a crump weir.
3. Similar study should be carried out using stones and cement models instead of wooden models.

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MOS₂ NANOMATERIALS FOR PHOTOCATALYSIS

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ABSTRACT

MoS₂ (molybdenum disulfide) nanomaterials have emerged as promising candidates for photocatalytic applications due to their unique structural and electronic properties. This abstract highlights the recent advancements in the synthesis, characterization, and photocatalytic performance of MoS₂ nanomaterials for efficient solar energy conversion and environmental remediation. The synthesis of MoS₂ nanomaterials involves various techniques such as chemical vapor deposition, hydrothermal synthesis, and solvothermal methods. These techniques allow precise control over the size, morphology, and crystallinity of the nanomaterials, which significantly influence their photocatalytic properties. Moreover, surface engineering and doping strategies have been explored to enhance the photocatalytic activity and stability of MoS₂ nanomaterials. Characterization techniques, including transmission electron microscopy, X-ray diffraction, and spectroscopic methods, have been employed to analyze the morphology, crystal structure, and surface chemistry of the synthesized MoS₂ nanomaterials. These studies provide valuable insights into the structure-property relationships governing the photocatalytic performance. MoS₂ nanomaterials exhibit excellent photocatalytic activity for various reactions, including water splitting, hydrogen evolution, carbon dioxide reduction, and organic pollutant degradation. The unique electronic band structure of MoS₂, with a direct bandgap in the visible range, enables efficient light absorption and charge separation. Additionally, the high surface area and abundant active sites on the nanomaterials facilitate enhanced reaction kinetics.

Keywords: MoS₂ Nanomaterials, Standardization, Molybdenum, Pharmaceuticals, Biocompatibility, Semiconductor.

1. INTRODUCTION

1.1 Definition

The prefix 'nano' is referred to a Greek prefix meaning 'dwarf' or something very small. Nano materials must have at least one dimension that is less than approximately 100 nanometers. According to the International Organization for Standardization (ISO), the prefix nano refers to a size ranging approximately from 1 to 100 nm. As a comparison, the diameter of a carbon atom



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is about 0.25 nm, and the distance between carbon atoms is 0.15 nm. Nanomaterials are thus larger than single atoms or even small groups of atoms (Bayda et al., 2019).

1.2 History

The use of nanotechnology is far from being new. For example, it was used around 2600 BC in dyes to impart color to fibers and fabric. Another example can be found in Middle Age churches, where stained glass artisans utilized nanoscopic scale (or nanoscale) gold and silver particles to impart ruby red and deep yellow color to window panels. Another example is the Damascus steel produced by the twelfth to the eighteenth century Middle Eastern metal smiths, which includes cementite nanowires inside carbon nanotubes. At that time, they had no way to observe the nanostructures they created. More recently, carbon black has been employed since 1910 to reinforce tires, without knowing that it was the interaction between rubber and the nanoscale carbon black particles that imparted the tires with increased hardness, strength, abrasion, and tear resistance. (Bayda et al., 2019).

1.3 The Imaginative Pioneers of Nanotechnology

The American physicist and Nobel Prize laureate Richard Feynman introduced the concept of nanotechnology in 1959. During the annual meeting of the American Physical Society, Feynman presented a lecture entitled "There's Plenty of Room at the Bottom" at the California Institute of Technology (Caltech). In this lecture, Feynman made the hypothesis "Why can't we write the entire 24 volumes of the Encyclopedia Britannica on the head of a pin?", and described a vision of using machines to construct smaller machines and down to the molecular level. This new idea demonstrated that Feynman's hypotheses have been proven correct, and for these reasons, he is considered the father of modern nanotechnology. After fifteen years, Norio Taniguchi, a Japanese scientist was the first to use and define the term "nanotechnology" in 1974 as: "nanotechnology mainly consists of the processing of separation, consolidation, and deformation of materials by one atom or one molecule".

After Feynman had discovered this new field of research catching the interest of many scientists, two approaches have been developed describing the different possibilities for the synthesis of nanostructures. These manufacturing approaches fall under two categories: top-down and bottom-up, which differ in degrees of quality, speed and cost.

The top-down approach is essentially the breaking down of bulk material to get nano-sized particles. This can be achieved by using advanced techniques such as precision engineering and lithography which have been developed and optimized by industry during recent decades. Precision engineering supports the majority of the micro-electronics industry during the entire production process, and the high performance can be achieved through the use of a combination of improvements. These include the use of advanced nanostructure based on diamond or cubic boron nitride and sensors for size control, combined with numerical control and advanced servo-drive technologies. Lithography involves the patterning of a surface through exposure to light, ions or electrons, and the deposition of material on to that surface to produce the desired material. The bottom-up approach refers to the build-up of nanostructures from the bottom: atom-by-atom or molecule-by-molecule by physical and chemical methods which are in a nanoscale range (1 nm to 100 nm) using controlled manipulation of self-assembly of atoms and molecules. Chemical synthesis is a method of producing rough materials which can be used either directly in product in their bulk disordered form, or as the building blocks of more advanced ordered materials. Self-assembly is a bottom-up approach in which atoms or



molecules organize themselves into ordered nanostructures by chemical-physical interactions between them. Positional assembly is the only technique in which single atoms, molecules or cluster can be positioned freely one-by-one. Nano-materials can be classified according to their source, their dimensions, and their constitutive materials. Here we discussed MoS₂ nano-materials (Bréchnac, et al., 2008).

1.4 MoS₂

It is the mostly studied and best known representative of the transition metal dichalcogenides, a famous group of 2D materials. It consists of a sandwich structure out of three atomic layers as shown in **Fig. 1**. The layer of molybdenum atoms (black) is encapsulated by two layers of sulfur atoms (yellow). Strong covalent bonding between sulfur and molybdenum atoms forms the backbone of such a three-layered structure, also referred to as a single-layer MoS₂ (Jaleel et al., 2022).

MoS₂ is a black-colored substance, insoluble in water, and like graphene, has a layered structure. It is mostly found in nature in the form of molybdenite MoS₂ has excellent thermal and chemical stability, which is a feature of layered transition metal compounds in general. As a result, it is employed in nanochemistry, catalysis, electrode materials, pharmaceuticals, nanomedical transportation, etc. MoS₂ is a typical n-type semiconductor with a layered structure that is quite similar to graphene. The band gap of MoS₂ grows as the number of the atomic layers decreases, resulting in desirable photoelectric characteristics. It is a semiconductor of the MX₂ type, where M stands for transition metals and X is for chalcogen. A single sheet is similar to a “sandwich” structure, where the Mo atom is sandwiched between two S atoms. MoS₂ layers, separated by 0.65 nm, are held together by van der Waals forces, and the layers are bound together by strong covalent bonds. Figure 2a.b show the crystal structure of MoS₂.

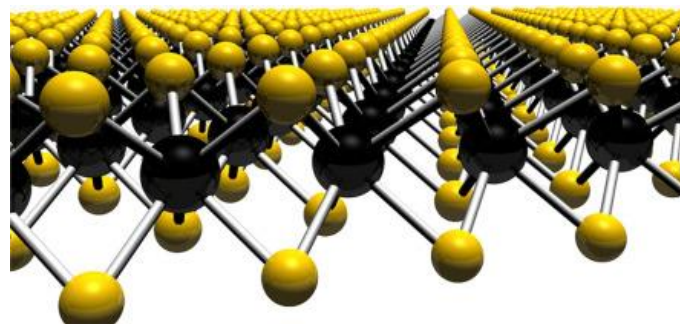


Fig1. MoS₂ structure three atomic layer.

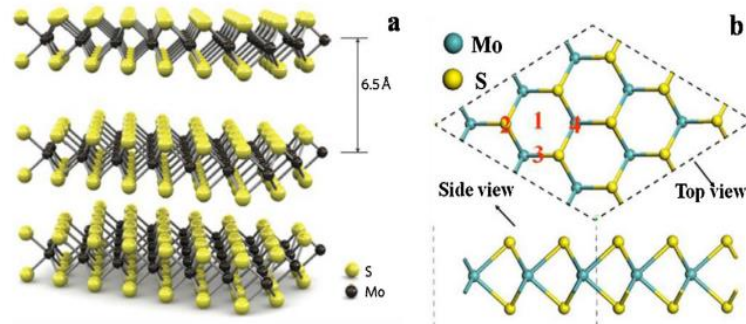


Figure 2. (a) Three dimensional representation of the structure of MoS₂. Single layers, 6.5 Å thick, can be extracted using scotch tape-based micromechanical cleavage. (b) Optimized structures of MoS₂ monolayer with four adsorption sites: (1) hollow site, (2) top site of the S atom, (3) Mo–S bridge site, and (4) top site of the Mo atom.

MoS₂ structure is a trigonal prismatic of S–Mo–S arrangement having two atomic planes of S surrounding an atomic plane of Mo in a sandwich-like structure. The length of the Mo–S bond is 1.54 Å, while the S–S bond is 3.08 Å in length. Accordingly, the MoS₂ single-layer thickness is about 0.62 nm. The MoS₂ semiconductor has an indirect bandgap of 1.2 eV. While the direct bandgap of a single-layered MoS₂ semiconductor is 1.8 eV. In addition, although multilayer MoS₂ is not photoluminescent, exfoliation-induced changes in its electronic structure lead to photoluminescent behavior in exfoliated monolayers. MoS₂ has three main phases 1 T MoS₂, 2H MoS₂ and 3R MoS₂. In the 1 T MoS₂ unit cell, the sulfur atoms coordinate the molybdenum atoms octahedrally 2H MoS₂ has the molybdenum atom coordinated by two S–Mo–S units in a trigonal prismatic geometry for each elemental cell; and with the same geometry as the 2H MoS₂, coming to the third phase the 3R MoS₂ but three units of S–Mo–S are directed along the c-axis instead of two. The 1 T phase has metallic properties, while the 2H and the 3R phases are semiconductors. Natural MoS₂ exists as the thermodynamically favored 2H phase, while the 1 T phase does not occur naturally and is usually obtained from lithium-intercalated 2H-MoS₂ interlayers by chemical exfoliation. Furthermore, the mono-layered 1 T-MoS₂ is metastable from the thermodynamic perspective, which tends to restructure to form the more stable phase, 2H-MoS₂. Consequently, the 1 T phase commonly happens in a multiphase form along with the 2H phase (He & Que, 2016).

Generally, molybdenum disulfide has very good chemical stability and thermal stability. They can form a highly efficient dry lubricating film. Molybdenum disulfide nanoparticles possess a low friction coefficient, good catalytic activity, and excellent physical properties. They also have a large active surface area, high reactivity, and increased adsorption capacity compared to the bulk material. Molybdenum disulfide nanoparticles appear in a black solid form.

1.5 Chemical Properties

The chemical properties of molybdenum disulfide nanoparticles are outlined in the following table.



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Chemical Data

Chemical symbol	MoS ₂		
CAS No.	1317-33-5		
Group	Molybdenum Sulfur 16		
Electronic configuration	Molybdenum	[Kr]	4d ⁵ 5s ¹
	Sulfur [Ne] 3s ² 3p ⁴		

Chemical Composition

Element	Content (%)
Molybdenum	59.94
Sulfur	40.05

1.6 Physical Properties

The physical properties of molybdenum disulfide nanoparticles are given in the following table.

Properties	Metric	Imperial
Density	5.06 g/cm ³	0.182 lb/in ³
Molar mass	160.07 g/mol	-

1.7 Thermal Properties

The thermal properties of molybdenum disulfide nanoparticles are provided in the table below.

Properties	Metric	Imperial
Melting point	1185°C	2165°F

1.8 MoS₂ based nanomaterials

MoS₂ based nanomaterials are discussed in a comprehensive way. Nanomaterials based on MoS₂ such as MoS₂ based nanomaterials, MoS₂ nanosheets, MoS₂ QD and MoS₂ nanoflowers. (Yadav et al., (2019).

a. MoS₂ based nanostructures

MoS₂ shows many properties including strong visible light absorption, biocompatibility, fluorescence quenching properties and many other interesting properties. Band gap of MoS₂ is greatly influenced by its thickness, 1.2 eV for bulk material and 1.8 eV for single layer therefore it has distinctive light response properties from ultraviolet to NIR light. The piezoelectric property, catalytic activity and band gap of MoS₂ can be tuned by modifying its phase, structure, size and doping with other materials. MoS₂ crystal displays 1T, 2H and 3R polytype formats, in which 2H is the most stable form. All of these excellent properties make MoS₂ an elegant material in numerous fields like opto-electronics, biomedical, dry-lubricants, catalysis, energy,



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environmental, sensing, etc. MoS₂ can form various morphologies like nanoplates, nanowires, nanotubes, nanorods, nanoflowers and quantum dots (Yadav et al., (2019).

b. MoS₂ nanosheets

In MoS₂, atomic layer of molybdenum is sandwiched between the two sulphide atomic layers through strong covalent bonds. The weak van der Waals forces existing between the adjacent layers are responsible for the production of single or few layered MoS₂ nanosheets from bulk three dimensional crystalline MoS₂. Consequently, application of mechanical forces help to overcome this van der waal forces which lead to the formation of monolayer MoS₂ nanosheets with a thickness of 6.5 Å. Quantum confinement plays a major role in the outstanding properties shown by the exfoliated MoS₂ nanosheets when compared to bulk MoS₂. Nanosized MoS₂ has much active site than bulk MoS₂ due to its direct band gap whereas the bulk material has indirect band gap. In spite of all these advantages, it is very difficult to obtain MoS₂ nanosheets due to its low yield, instability and expensive nature. Mechanical exfoliation, chemical vapour deposition (CVD), chemical exfoliation and liquid phase exfoliation (LPE) are the most common methods used for MoS₂ nanosheet synthesis (Yadav et al., (2019).

c. MoS₂ quantum dots

Among numerous variety of 2D QDs, MoS₂ QDs are the most promising ones due to their attractive photoluminescence emission better biocompatibility and ease of fabrication. Zero dimensional MoS₂ QDs can be synthesized through controlling the size of MoS₂ less than 10 nm. QDs give greater number of conductive and catalytic edge sites than their 2H-MoS₂ flakes. Moreover, it has greater surface to volume ratio, tunable fluorescence emission and small size than other MoS₂ nanostructures. Because of the edge effects and quantum confinement, MoS₂ QDs hold unique electronic and optical properties. Thereby, finding numerous application in biomedical, sensors, energy and electrocatalysis. Top-down and bottom-up are the two general methods for the synthesis of MoS₂ QDs (Yadav et al., (2019).

d. MoS₂ nanoflowers

Nanoflowers are newly established nanoparticle systems showing resemblance to flowers in 100–500 nm nanoscale range. It contains many nano-sized petals to cover a greater surface area in a small structure and possess better carrier immobility and charge transfer. Moreover, surface reaction efficiency is raised in this 3D (three dimensional) nanoflower structure. Recent studies prove that, 3D MoS₂ nanosystems are anticipated to have many applications due to their notable advantages like greater aspect ratio and many active edges. Three-dimensional MoS₂ nanostructures are mainly obtained through hydrothermal synthesis. In one study, hydrothermally synthesised MoS₂ nanoflowers showed better sunlight-induced photocatalytic properties towards the degradation of methyl orange, oxytetracycline hydrochloride, methylene blue and rhodamine (Yadav et al., (2019).

1.9 Applications

Molybdenum disulfide (MoS₂) nanomaterials have been widely used in various fields such as energy store and transformation, environment protection, and biomedicine due to their unique physicochemical properties. The key applications of molybdenum disulfide nanomaterials are as follows: In lubricant applications, catalyst for coal liquefaction. It is used to prepare special materials, catalytic materials and gas storage. It's nanocomposites in cancer diagnosis, mainly



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focusing on biosensors, bioimaging, chemotherapy, phototherapy, microwave hyperthermia, and combination therapy. Used in gas sensors. It is also used in photocatalysis.

1.10 Photocatalysis

The term photocatalyst is a combination of two words: photo related to photon and catalyst, which is a substance altering the reaction rate in its presence. Therefore, photocatalysts are materials that change the rate of a chemical reaction on exposure to light. This phenomenon is known as photocatalysis. Photocatalysis includes reactions that take place by utilizing light and a semiconductor. The substrate that absorbs light and acts as a catalyst for chemical reactions is known as a photocatalyst. All the photocatalysts are basically semiconductors. Photocatalysis is a phenomenon, in which an electron-hole pair is generated on exposure of a semiconducting material to light. The photocatalytic reactions can be categorized into two types on the basis of appearance of the physical state of reactants (Ameta et al., 2018).

Homogeneous photocatalysis: When both the semiconductor and reactant are in the same phase, i.e. gas, solid, or liquid, such photocatalytic reactions are termed as homogeneous photocatalysis.

Heterogeneous photocatalysis: When both the semiconductor and reactant are in different phases, such photocatalytic reactions are classified as heterogeneous photocatalysis.

Photocatalysis processes takes place under light irradiation in the presence of photocatalyst. Nanomaterials in photocatalysis were investigated as smart materials for water purification systems due to the excellent surface area and morphological properties. Molybdenum disulfide (MoS_2) and its variants exhibit high photocatalytic activity under irradiation by visible light as well as good stability and recyclability, which are desirable for all photocatalytic applications.

2. REVIEW OF LITERATURE

Peng *et al.* (2014) investigated that a novel molybdenum disulfide (MoS_2) and graphitic carbon nitride (g- C_3N_4) composite photo-catalyst was synthesized using a low temperature hydrothermal method MoS_2 nanoparticles formed on g- C_3N_4 nano-sheets greatly enhanced the photo-catalytic activity of g- C_3N_4 . The photo-catalyst was tested for the degradation of methyl orange (MO) under simulated solar light. Composite 3.0 wt% $\text{MoS}_2/\text{g-C}_3\text{N}_4$ showed the highest photo-catalytic activity for MO decomposition. MoS_2 nanoparticles increased the interfacial charge transfer and thus prevented the recombination of photo-generated electron-hole pairs. The novel $\text{MoS}_2/\text{g-C}_3\text{N}_4$ composite was therefore shown as a promising catalyst for photo-catalytic degradation of organic pollutants using solar energy. (Peng, and Li, 2014).

Li *et al.* (2019) investigated that MoS_2 -based photocatalysts attracted wide attention as they possessed a suitable band gap for visible-light harvesting, made it a promising earth-abundant photocatalyst for hydrogen production, environmental remediation, and photosynthesis. However, the rapid recombination of photo-generated electron-hole pairs, limited quantity of active edge sites, and difficult photocatalyst separation and recycling hinder the practical application of this material. In their review, recent development of MoS_2 -based photocatalysts in various photocatalytic applications was summarized. In addition, possible approaches to enhance photocatalytic activity and separate photocatalysts from reaction media were discussed to provide a future direction in highly efficient photocatalyst design (Li *et al.*, 2019).



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Shah *et al.* (2022) demonstrated that Molybdenum disulfide (MoS_2), with a two-dimensional (2D) structure, had attracted huge research interest due to its unique electrical, optical, and physicochemical properties. MoS_2 had been used as a co-catalyst for the synthesis of novel hetero-junction composites with enhanced photo-catalytic hydrogen production under solar light irradiation. They briefly highlighted the atomic-scale structure of MoS_2 nano-sheets. The top-down and bottom-up synthetic methods of MoS_2 nano-sheets was described. Additionally, they discussed the formation of MoS_2 hetero-structures with titanium dioxide (TiO_2), graphitic carbon nitride (g-C $_3$ N $_4$), and other semiconductors and co-catalysts for enhanced photo-catalytic hydrogen generation. Their review addressed the challenges and future perspectives for the enhancement of solar hydrogen production performance in hetero-junction materials using MoS_2 . (Shah *et al.* 2022).

Wu *et al.* (2018) examined that photocatalytic degradation was an emerging, efficient and energy-save technology for the removal of organic contaminants from the water environment. With the development of two-dimensional functional materials, molybdenum disulfide (MoS_2) had become one of the most popular emerging co-catalysts due to its high photo-catalytic activity, strong adsorbability, low cost and non-toxicity, especially applied to the photocatalytic degradation of organic contaminants. In their paper, they review the recent research progress of graphene, carbon-nitrogen compounds, TiO_2 and bismuth compounds supported on MoS_2 co-catalyst, which were applied to photocatalytic degradation of various organic contaminants such as methylene blue (MB), methyl orange (MO) and rhodamine B (RhB), etc. Meanwhile, the basic processes of photocatalytic degradation of organic pollutants had also been briefly analyzed and compared. More importantly, MoS_2 co-catalyst played an integral role in nanocomposites, especially in accelerating photo-induced electron transport and reducing electron recombination rates. It was indicated that MoS_2 -based composites were promising photocatalysts for photocatalytic degradation of environmental pollutants as co-catalyst. (Wu *et al.*, 2018).

Tian *et al.* (2017) investigated that the flower-like MoS_2 nanoparticles (NPs) consisted of ultra-thin MoS_2 nanosheets were synthesized via a facile one-pot hydrothermal method. The MoS_2/ZnO p-n heterostructure was formed by coating n-type ZnO on the surface of flower-like MoS_2 NPs through the seed-mediate route and post-annealing treatment. The effects for the dye removal and photocatalytic performances after ZnO coating were systematically investigated. The results demonstrated that the coating of ZnO nanoparticles had a positive promotion to the photodegrading properties while negative effect on the adsorption capacity of the MoS_2/ZnO heterostructures (Tian *et al.*, 2017).

Zhou *et al.* (2013) reported that MoS_2 nanosheet-coated TiO_2 nanobelt heterostructures referred to as $\text{TiO}_2 @\text{MoS}_2$ with a 3D hierarchical configuration were prepared via a hydrothermal reaction. The TiO_2 nanobelts used as a synthetic template inhibited the growth of MoS_2 crystals along the c-axis, resulting in a few-layer MoS_2 nanosheet coating on the TiO_2 nanobelts. The as-prepared $\text{TiO}_2 @\text{MoS}_2$ heterostructure showed a high photocatalytic hydrogen production even without the Pt co-catalyst. Importantly, the $\text{TiO}_2 @\text{MoS}_2$ heterostructure with 50 wt% of MoS_2 exhibited the highest hydrogen production rate of $1.6 \text{ mmol h}^{-1} \text{ g}^{-1}$. Moreover, such a heterostructure possessed strong adsorption ability toward organic dyes and showed high performance in photocatalytic degradation of the dye molecules. (Zhou *et al.*, 2013).

Khan *et al.* (2022) investigated that Transition metal dichalcogenides (TMDs) was promising materials for photo-catalytic functions. In class of TMDs, MoS_2 was comprehensively explored



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as a co-catalyst due to the extraordinary activity for photocatalytic activity of organic dye degradation. But the catalytic activity of MoS_2 was generated through S ions on depiction edges. Also numerous of S ions existed on basal planes was catalytically inactive. The insertion of external metals in MoS_2 organism were extensive way for activation of basal planes surface to enhance concentration of catalytically active sites. For this purpose, nanoparticles of Nickel (Ni) doped MoS_2 was prepared by hydrothermal technique. Structural and morphological analysis was characterized by XRD and SEM, respectively. XRD results showed that Ni was completely doped into MoS_2 . SEM showed that pure MoS_2 had sheet like structure and Ni doped MoS_2 had mix disc and flower like structure. Band gap energy was observed in declining range of 2.30–1.76 eV. The photo-catalytic activity of pure MoS_2 and Ni doped MoS_2 were evaluated by degrading MB and RhB dyes under UV light irradiation. MB dye degradation of MB was 71% for pure MoS_2 . For 1% to 5% Ni doping in MoS_2 , MB dye degraded from 85% to 96%. It means that MB dye degradation of MB was enhanced continuously by increasing the concentration of Ni doping. RhB dye degradation of RhB was 62% for pure MoS_2 . For 1% to 5% Ni doping in MoS_2 , the RhB dye degraded from 77% to 91%. (Khan et al., 2022).

Lalithambika et al. (2019) investigated that transition metal dichalcogenide MoS_2 nanoparticles had been synthesized by an inexpensive slow evaporation method. The X-ray diffractogram (XRD) showed that the grown particles were in crystalline nature with mixed phase. The calculated average particle size of the prepared nanoparticles is 56 nm. The Fourier transform infra-red (FTIR) and Raman studies confirmed the particles were bulk MoS_2 in nature. Scanning electron microscope (SEM) and energy-dispersive X-ray spectroscopy (EDX) images confirmed the porosity and the presence of Mo and S elements. Photo-catalytic activity of the prepared nanoparticles were tested against methylene blue (MB), and malachite green (MG) dyes and the efficiencies were found to be 93.68% and 85.33%, respectively. The degradation rate constant of MoS_2 nanoparticle against MB and MG dyes were 0.0199, 0.01389 min^{-1} , respectively, under visible light for 75 min irradiation. A density functional theory (DFT) calculation had been performed to validate the photo-catalytic experimental results based on band-gap, band-edge potentials, and effective mass. (Lalithambika et al., 2019).

Li et al. (2019) demonstrated that a series of nanostructured molybdenum disulfide (MoS_2) with various morphologies, such as spherical, flower-like, coil and hollow were synthesized via a one-step hydrothermal method. The photo-catalytic properties of as obtained MoS_2 were evaluated by degrading methylene blue (MB) under visible light. Interestingly, the flower-like MoS_2 exhibited the best photo-catalytic activities. It was ascribed that the suitable porous structures of flower-like MoS_2 could increase the number of exposed active sites, which facilitated the efficient adsorption and transfer of MB to the active sites. Meanwhile, the special structure of flower-like MoS_2 could improve light absorption efficiency owing to the increasing of light paths. Furthermore, its 2D stacked petals possessed abundant active sites, which would effectively affect the photo-catalytic efficiency. Their study indicated that the surface area of nanomaterials was not a dominated factor in photo-catalytic performance. The surface morphology had a great influence on the photocatalytic performance, which provided a feasible guide for synthesizing efficient photocatalytic nanomaterials. (Li et al., 2019).

Rahimi et al. (2019) investigated that the few-layer exfoliated MoS_2 nanosheets were easily composited with ZnO nanorods. It was found that MoS_2 nanosheets could enhance the sunlight-induced photocatalytic activity rate of ZnO by 74%. In addition, they showed that under UV-blocked sunlight irradiation, MoS_2 weakened the photocatalytic activity rate of ZnO by 33%.



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Finally, they discussed the mechanisms behind the enhanced (weakened) photocatalytic activity under sunlight (UV-blocked sunlight) irradiation based on the UV-Vis absorption and photoluminescence spectra as well as the potential band diagrams of the ZnO/MoS₂ composite. (Rahimi et al., 2019).

Putritama et al. (2020) investigated that decorating ZnO with nano-sheets of MoS₂—a transition metal dichalcogenide characterized by a relatively narrow band gap—was a promising way to increase the photo-catalytic activity of ZnO. However, limited studies reported the effect of the layer number of MoS₂ nano-sheets on the photo-catalytic performance of ZnO/MoS₂. In their work, ZnO nano-rods were decorated with multilayer and few-layer (~11 and ~3 atomic layers) MoS₂ nano-sheets exfoliated for 4 h and 8 h, respectively. This type-II heterostructures were subsequently used as photo-catalysts for the degradation of methyl blue. Their results showed that the photo-catalytic efficiency of the ZnO/ MoS₂ was less than that of pristine ZnO and it further decreased by 11% with increasing the number of layers and length of the MoS₂ nano-sheets. This effect might be due to the decrease of adsorption capacity of the water molecules on the ZnO/MoS₂ system as indicated by the increasing contact angle from 17°–23° to 73°–76°. The increase in contact angle for ZnO/MoS₂ could be due to the hydrophobic nature of the basal plane of the 2H-MoS₂ phases, which were called inactive catalytic sites. (Putritama et al. (2020).

Das et al. (2021) investigated that fabrication of heterogeneous photo-catalysts had received increasing research interest due to their potential applications for the degradation of organic pollutants in waste water and evolution of carbon-free hydrogen fuel via water splitting. Here, they reported the photo-degradation and photo-catalytic hydrogen generation abilities of nanostructured LaFeO₃-MoS₂ photo-catalyst synthesized by facile hydrothermal technique. Prior to conducting photo-catalytic experiments, structural, morphological and optical properties of the nano-composite were extensively investigated using X-ray diffraction analysis, field emission scanning electron microscopy and UV-visible spectroscopy, respectively. Nanostructured LaFeO₃-MoS₂ photo-degraded ~96% of Rhodamine B dye within only 150 minutes which was considerably higher than that of LaFeO₃ and commercial Degussa P25 titania nanoparticles. The LaFeO₃-MoS₂ nano-composite also exhibited significantly enhanced photo-catalytic efficiency in the decomposition of a colorless probe pollutant, ciprofloxacin eliminating the possibility of the dye-sensitization effect. Moreover, LaFeO₃-MoS₂ demonstrated superior photo-catalytic activity towards solar hydrogen evolution via water splitting. Considering the band structures and contribution of reactive species, a direct Z-scheme photo-catalytic mechanism was proposed to rationalize the superior photo-catalytic behavior of LaFeO₃-MoS₂ nano-composite. (Das et al., 2021).

Fu et al. (2022) investigated that a visible light-driven polymeric carbon nitride (PCN)/(Pt)/nano-spherical MoS₂ photo-catalysts was prepared using a self-assembly method. The structure of photo-catalysts was explored by FT-IR, XPS, XRD, BET, SEM and TEM. Meanwhile, the energy band structure and electron hole separation efficiency were also analyzed by UV-Vis and PL spectra. In addition, the photo-catalytic performance of photocatalyst were test by photo-catalytic degradation of Rhodamine B and photo-catalytic hydrogen evolution. The results showed that PCN/ 2.0%MoS₂ showed the best photo-catalytic performance, and the degradation rate of Rhodamine B could reach 98.39% within 150 min. Besides, the introduction of Pt nanoparticles significantly improved the photo-catalytic activity. The degradation rate of Rhodamine B reached 100% within 150 min, and the rate of photo-



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catalytic hydrogen production of PCN/Pt/MoS₂ system was increased by 21.3% over the PCN/2.0%MoS₂ system. The separation mechanism of electron and hole was Z-scheme mechanism and the main active substances for photocatalytic degradation were $\cdot\text{O}_2^-$ and h^+ (Fu et al., 2022).

Li et al. (2019) investigated that the developed a piezoelectric promoted full solar spectrum photo-catalytic system by assembling full solar response Ag₂O NPs on piezoelectric MoS₂ NFs. The separation of photo-induced electrons and holes could enhance the photo-catalytic properties of photo-catalysts. A piezoelectric field was created inside piezoelectric materials, such as ZnO and MoS₂, by applying strain. The electrons and holes become separated under the driving force of the piezoelectric field. Here, we proposed combining piezoelectric MoS₂ nano-flowers (NFs) and full solar response Ag₂O nanoparticles (NPs) to form a MoS₂@Ag₂O hetero-structure and achieve high efficiency full solar (UV, visible, and near infrared) photo-catalysis. Under both full solar light and ultrasonic excitation, the MoS₂@Ag₂O hetero-structures could rapidly degrade methyl orange (MO) in aqueous solution. A built-in electric field was formed by the spontaneous polarization potential of the MoS₂ NFs during this process an ultrasonic wave as a driving force can consecutively change the potential created by the piezoelectric effect. Under light irradiation, electrons and holes were generated in the Ag₂O NPs, and the photo-generated electrons and holes with opposite signs in the two Ag₂O NPs at the two surfaces of the MoS₂ NFs, could be separated respectively, along the spontaneous polarized direction. Therefore, the piezoelectric effect induced enhancement of carrier separation under ultrasonic excitation can improve the full solar photo-catalytic performance of the MoS₂@Ag₂O hetero-structures. (Li et al., 2019).

Zhao et al. (2013) demonstrated that the co-catalysts for H₂ production were often made from expensive noble metals, such as the most efficient Pt. The alternative non-noble metal co-catalysts with low cost and high efficiency were therefore highly desirable for economically viable H₂ production. They demonstrated that a CdS/MoS₂/Mo sheets system simultaneously containing photo-catalysts, co-catalysts, and conductive supports, was prepared via the one-step hydrothermal process by Mo sheets as template and Mo sources. The obtained CdS/MoS₂/Mo sheets possessed the superior photo-catalytic H₂ production via water splitting under visible light irradiation, which achieved an extraordinary H₂ production of 4540 mol h⁻¹ g⁻¹, up to 28.6 and 3.6 times greater than that of CdS alone and Pt/CdS. The synergetic effect of MoS₂ as co-catalysts and Mo sheets as conductive supports contributed to the dramatically improved photo-catalytic H₂ evolution activity of CdS photo-catalysts, by means of facilitating charge carriers separation and providing active sites for proton reduction. These findings provided a straight forward and practical route to produce cheap and efficient co-catalysts for large-scale water splitting. (Zhao et al., 2013).

Liu et al. (2017) investigated that Molybdenum disulfide (MoS₂) had extensive applications in industries as solid lubricants and catalysts. To improve the lubricating performance of MoS₂, novel double-hollow-sphere MoS₂ (DHSM) nanoparticles with an average diameter of approximately 90 nm were synthesized on sericite mica (SM). The DHSM/SM composite was used as an additive in polyalphaolefin oil, friction and wear decreased by 22.4% and 63.5% respectively. The low friction and wear were attributed to the easy exfoliation of DHSM. The DHSM/SM composite was then rubbed under 40 MPa for 1 h to investigate the exfoliation and functional conversion behaviors of DHSM. Results showed that DHSM (lubricating structure) on SM could be completely exfoliated into nano-sheets (catalytic structure) by rubbing. The



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nano-sheets exfoliated from DHSM presented good photo-catalytic activity for the removal of organic compounds from waste water. Their work provided both a novel solid lubricant for industrial applications and a possible approach to designing a novel green lubricant for use as a photo-catalyst in organic waste treatment after lubricating service life. (Liu et al., 2017).

Wang et al. (2016) investigated that novel co-catalysts based on few layered MoS₂ and TiO₂ nano-materials had been designed by growing MoS₂ nano-sheets on the surface of TiO₂ nano-spheres through a facile hydrothermal method. The method allowed the formation of TiO₂/MoS₂ coreshell hetero-structures of uniform morphologies and stable structure and provides a good control over shell thickness. The mechanism that formed these hetero-structures was discussed in detail. In addition, as co-catalyst, MoS₂ nano-sheets could enlarge the light harvesting window to include visible light and improve the photo-catalytic ability of TiO₂. Using Rhodamine B as the model, the resultant hetero-structure was demonstrating to possess excellent and stable photo-catalytic activity in the degradation of organic pollutants under visible light illumination. The TiO₂ / MoS₂ hetero-structures possessed this catalytic activity due to their large surface area and their excellent interface for separating holes and electrons. Their novel hetero-structure nano-materials possessed potential applications in water treatment, degradation of dye pollutants, and environmental cleaning. (Wang et al., 2016).

Su *et al.* (2020) investigated that a novel few-layer MoS₂@TiO₂ hollow sphere heterostructures (MoS₂@TiO₂ HSH) was successfully synthesized by a hydrothermal method which was constructed by few-layer MoS₂ grown on TiO₂ hollow spheres. Systematical characterization revealed that the hollow sphere structure was preserved during the hydrothermal process, while the surface of hollow spheres TiO₂ became roughened after the few-layer MoS₂ grown on TiO₂. The MoS₂@TiO₂ HSH showed excellent photo-catalytic ability, assessed by the performance of degrading Rhodamine B (RhB) solution under visible light (400 nm $\leq \lambda \leq$ 800 nm). The photo-degradation rate based on MoS₂@TiO₂ HSH could be 95% after 120 min, which was more efficient than the pure TiO₂ and MoS₂. The reason why the composites had such an excellent photo-catalytic performance was the formation of hetero-structures enhanced the ability of separating the photo-generated electrons–holes further reduces the electron–hole recombination rate. Their findings would shed light on the design of flexible photo-catalysis material (Su et al., 2020).

Benavente et al. (2018) investigated that a series of novel hetero-structured hybrid layered ZnO and MoS₂ nano-sheets composites were successfully prepared with different MoS₂ contents. Among all the prepared materials, ZnO/MoS₂ (1:0.05) composite showed enhanced photo-catalytic activity for methylene blue degradation under direct solar light compared with pristine ZnO. The MoS₂ component played a key role for the visible light activity of the composite system at longer wavelengths. The kinetic equations of photo-catalytic reaction and possible photo-catalytic degradation mechanism were investigated. Their results indicated that it belonged to the zero order kinetic and the photo-generated electrons were transferred from hybrid layered ZnO to the MoS₂ nano-sheets, facilitating an interfacial electron transfer suppressing the recombination of charge carriers during the photo-catalytic degradation. (Benavente et al., 2018).

Liu et al. (2018) investigated that the design of highly efficient catalysts had already been a challenge in the exploration of renewable energies based on nanotechnologies. Herein, a feasible strategy of three-dimensional (3D)/two-dimensional (2D) nano-junctions was employed to achieve a prominently enhanced activity in both solar hydrogen evolution and



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electrochemical hydrogen generation from water splitting. Flower-like MoS₂ nanoparticles with thin-layers were fabricated using a one-pot hydrothermal process and were further attached to g-C₃N₄ nano-sheets via their (002) crystal planes to form an intimate face-to-face contact. The hybrid catalysts exhibited a red-shift to the visible light region with an enhanced absorption capacity. At the optimal loading of 0.5 wt% MoS₂, MoS₂/g-C₃N₄ exhibited the highest photo-catalytic H₂ evolution rate of 867.6 μmol h⁻¹ g⁻¹ under simulated sunlight irradiations, which is 2.8 times as high as that of pure g-C₃N₄. Furthermore, the average photo-catalytic H₂ evolution rate was elevated to ca. 5 times as high as that of pure g-C₃N₄ under visible light irradiations. The synergistic effect responsible for the enhanced HER (hydrogen evolution reaction) performance might be originated from the intimate interface between the light-harvesting g-C₃N₄ and MoS₂ as the active sites with the decreased over potential, lowered charge-transfer resistance and increased electrical conductivity, leading to a more efficient charge separation and a higher MoS₂/g-C₃N₄ lead to the enhancement of electrochemical HER performance compared to pure g-C₃N₄. Their work provided a feasible protocol for rational design of highly efficient HER electro-catalysts and photo-catalysts towards future energy innovation. (Liu et al., 2018).

Wang et al. (2016) investigated that MoS₂ nanodots modified TiO₂ (P25) composite photocatalyst (MoS₂/P25) was fabricated via a facile liquid ultrasonic mixing method. Compared to the pure P25, the MoS₂/P25 exhibited improved photocatalytic degradation activity under simulated sunlight with rhodamine B (RhB) and methyleneblue (MB) as the target pollutants. RhB or MB (40 mL 10 mg/L) completely degraded within 20 min. and the kinetic constant reached 0.221 and 0.253 min⁻¹ for RhB and MB, respectively. Based on the characterization of transient photocurrent response measurement and UV-Vis. diffused reflectance spectra, a possible photocatalytic mechanism was proposed. The enhanced photocatalytic performance was attributed to the heterostructure of P25 and MoS₂ nanodots, improved their charge separation and enhancing their absorption capacity to the full sunlight spectrum. We believed that this study would contribute to the development of new photocatalysts and improving the catalytic performance of traditional photocatalysts. (Wang et al. (2016).

Nazneen et al. (2020) demonstrated that nanoparticles of Ag doped molybdenum disulfide (AgeMoS₂) were synthesized by hydrothermal process. The structural, morphological, and optical characteristics of these nanoparticles were characterized by scanning electron microscopy (SEM), Raman spectroscopy, and photoluminescence spectroscopy (PL), respectively. Raman spectra confirmed the formation of MoS₂ and Ag-doped MoS₂ nanoparticles. SEM images indicated that sheet-like structure is prepared in undoped MoS₂, while AgeMoS₂ had a particle like structure. PL peaks were observed at 600 nm (2.06 eV), 610 nm (2.03 eV), 700 nm (1.77 eV), 725 nm (1.71 eV), and 730 nm (1.69 eV) for pure, 1% and 2% Age MoS₂. When the doping amount of Ag was increased further (i.e., to 3% Ag-doped MoS₂), new peaks at 636 nm (1.9 eV) and 663 nm (1.87 eV) were observed due to an increase in structural defects. The photocatalytic activity (PCA) of undoped and Ag-MoS₂ was estimated by monitoring the degradation of rhodamine blue (RhB) and methylene blue (MB) dyes. The PCA of AgeMoS₂ samples were greater than that of undoped MoS₂ when irradiated with visible light, which was attributed to increased electron-hole pair separation. (Nazneen et al., 2020).

Thomas et al. (2021) reported that the two-dimensional (2D) molybdenum disulfide (MoS₂) based materials were of great interest because of their capacity to efficiently absorb



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electromagnetic spectrum in the visible region. Starting from the structural and electronic properties, there review discussed the synthesis strategies of 2D MoS₂. The major photocatalytic applications of 2D MoS₂ such as hydrogen evolution, pollutant degradation, self-cleaning, photoelectrochemical water splitting, and microbial disinfection were summarized. The mechanistic understanding of various photocatalytic applications of 2D MoS₂ were summarized through schematic diagrams. In addition, their review showed the methodologies for improving the 2D MoS₂ photocatalysts and recapitulates the research directions in this area of semiconductor photocatalysis. (Thomas et al., 2021).

Raja et al. (2017) investigated that a PbS/MoS₂ nanocomposite was synthesized in different molar ratio of PbS 0.5%, 1.0% and 1.5% by precipitation and deposition method and successfully characterized by various instrumental techniques such as UV-visible diffuse reflectance spectra (DRS), X-ray diffraction (XRD), Scanning electron microscopy (SEM), Energy dispersive X-ray spectrometry (EDX), BET-surface area, photoluminescence (PL) spectroscopy. The photocatalytic activity was monitored via the degradation of methylene blue dye and the results revealed that 1% PbS/MoS₂ better photocatalytic activity than that of 0.5% PbS/MoS₂ and 1.5% PbS/MoS₂. The effect of operational parameters such as pH and catalyst dosage on the photocatalytic activity was investigated. The PbS-MoS₂ nanocomposite exhibit excellent photocatalytic degradation on methylene blue (MB) dye under visible light irradiation. (Raja et al., 2017).

Wang *et al.* (2018) examined that nano-sized materials had attracted tremendous attentions because of their promising practical applications and theoretical values. The nano-sized materials were able to not only enhanced the intrinsic properties of their bulk counterparts but also give birth to new promising properties. Herein, heterojunctions consisted of graphene oxide (GO) and three different MoS₂ nanostructures, including nanoflowers, nanoparticles, and quantum dots, were constructed and used as photocatalysts in water splitting. The electrochemical behavior and photocatalytic performance of MoS₂/GO composites were found closely related to the particle size and morphology of MoS₂. Compared to bulk MoS₂/GO photocatalyst, nano-sized MoS₂/GO heterostructures exhibited obviously enhanced performance in photocatalytic hydrogen generation. Benefitting from the surface effect and the quantum confinement in MoS₂ quantum dots, MoS₂ quantum dots/GO displayed the highest photocatalytic activities. Their study indicated that the decrease in the dimension of MoS₂ could effectively increase the photocatalytic hydrogen evolution performance of MoS₂/GO heterostructures, and thus suggested preferred strategy to design other HER photocatalysts based on MoS₂. (Wang et al., 2018).

Thangavel *et al.* (2017) investigated that the use of two-dimensional nanomaterials as co-catalysts in the photodegradation of toxic compounds using light irradiation were an attractive ecofriendly process. In their study, they prepared a novel MoS₂/Ag₂WO₄ nano hybrid via a one-step hydrothermal approach and the photocatalytic properties were investigated by the degradation of methyl-orange under stimulated irradiation. The nanohybrid exhibits enhanced efficiency in dye degradation compared to the bare Ag₂WO₄ nanorods; the same had been evidently confirmed with UV-visible spectra and total organic carbon removal analysis. The pseudo-first order rate constant of the nano hybrid was nearly 1.8 fold higher than that of the bare Ag₂WO₄ nanorods. With the aid of classical radical quenching and photoluminescence spectral analysis, a reasonable mechanism had been derived for the addition of MoS₂ to nano hybrids to enhance the photocatalytic efficiency. MoS₂ prevented photo corrosion of Ag₂WO₄

and also diminished the number of photogenerated electron-hole recombination. Their findings could provide new insights in understanding the mechanism of the MoS₂/Ag₂WO₄ nanohybrid as an efficient photocatalyst suitable for waste-water treatment and remedial applications. (Thangavel et al., 2017).

3. METHODS and MATERIAL

Experimental procedure

For the preparation of MoS₂ nanoparticles, the chemicals are purchased in analytical grade (AR) with 98% purity. In the slow evaporation process, 2.4712 g of ammonium heptamolybdate and 0.15224 g of thiourea were taken as sources for Mo and S. The source materials are dissolved in 50 ml of distilled water under magnetic stirring, and kept at 60 °C for 24 h. The measured pH value of the solution was six. The precursor solution was allowed to evaporate slowly under ambient condition, and the resultant products were exploited. Then it was washed with the distilled water–ethanol mixture and centrifuged. After that, the colloidal suspension was dried at room temperature and in normal air atmosphere. The final products of fine nanoparticles were obtained. A schematic of the experimental process is shown in Fig. 1 (Lalithambika, et al., 2019).

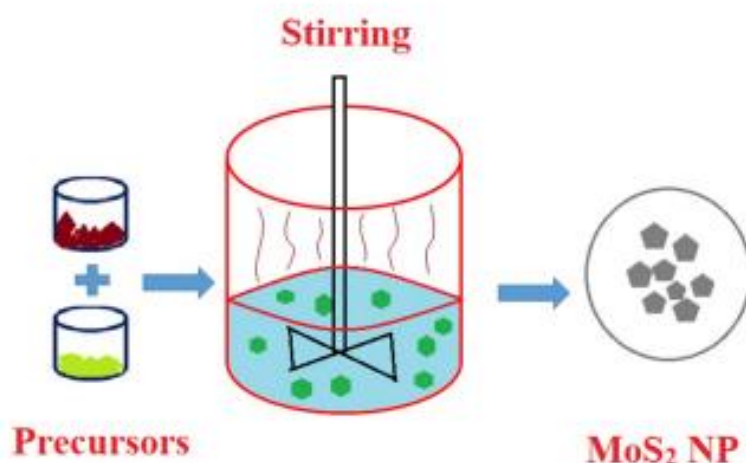


Figure 1. Experimental process of MoS₂ nanoparticle preparation

Characterization

The prepared particles were characterized using X-ray diffractometer (XRD) for crystal structure analysis, morphological analysis using scanning electron microscope (SEM), elemental analysis using energy-dispersive X-ray analysis (EDAX) system, functional group analysis using Fourier infra-red spectrophotometer (FTIR), and vibrational and rotational analyses of the prepared particles are characterized by Raman spectroscopy.

Evaluation of dye degradation

The dye degradation efficiency of the prepared nanoparticles is tested against two industrial standard dyes MB and MG under the illumination of a Xe arc lamp of power 300 W. A required amount of prepared nanoparticles were dissolved in 100 ml of aqueous solutions of MB and MG separately and stirred in the dark atmosphere until the equilibrium is reached. Under the



visible light irradiation, the dye and sample mixtures were exposed for every 15 min. The photocatalytic reaction was monitored and recorded by taking the absorption spectrum for MB ($\lambda=664$ nm) and MG ($\lambda=617$ nm) using a UV–visible spectrometer (Systronics, 2003).

Computational details

Density functional theory implemented in ATK-VNL [26] package is employed to validate the photocatalytic performance of MoS₂ nanoparticles. A supercell of MoS₂ consisting of 32 atoms is constructed and optimized. The exchange–correlation interaction was estimated by generalized gradient approximation (GGA) with Perdew–Burke–Ernzerhof parameterization. A 4×4×4 Monkhorst–Pack k-point grid was used to treat the supercell. Cutoff energy of 400 eV Å⁻¹ and total energy tolerance of 105 eV were used for the total energy calculation. The effective mass calculation is done along (1 0 1) direction of the optimized supercell.

4. RESULTS and DISCUSSIONS

4.1. Structural and morphological properties

The phase composition and the crystalline structure of the prepared sample are analyzed by X-ray diffractograms between 10° and 80° (Fig. 2). The XRD patterns show that the sample is mainly composed of MoS₂ and a small amount of Mo₂S₂. The diffraction peaks (2θ) positioned at 14.39°, 29.02°, 32.68°, 35.88°, and 39.55° are assigned to the lattice planes (002) (004) (100) (102) (103), respectively, of crystalline MoS₂ (JCPDS card no. 65-0160). However, the peaks at 13.76°, 19.23°, 30.73°, and 31.48° are attributed to the lattice planes (101) (110) (121) (113) of Mo₂S₂ (JCPDS card no. 82-1709). The crystalline size of the prepared MoS₂ nanoparticles is calculated using Scherrer's formula.

$$D = \frac{K\lambda}{\beta \times \cos \theta}$$

Table 1 shows the calculated crystalline and lattice parameters of the prepared MoS₂ nanoparticles.

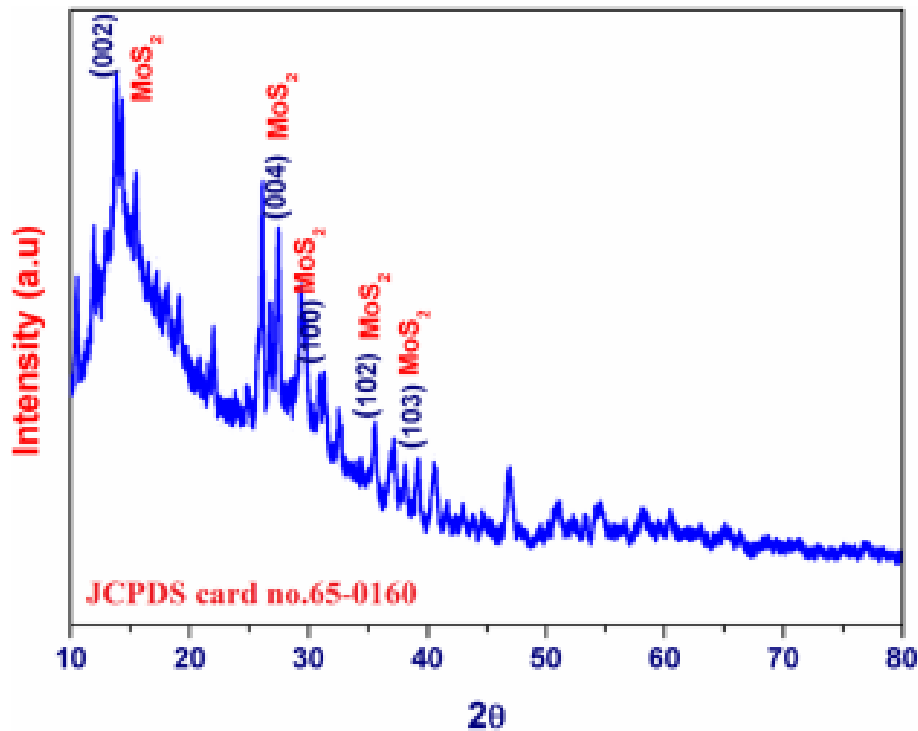


Figure 2. XRD pattern of prepared MoS₂ nanoparticles

Table 1 Lattice parameters of MoS₂ nanoparticles.

Sample	D(nm)	a (Å)	c (Å)	c/a
MoS ₂	56	3.1667	12.421	0.2549

The morphological and elemental analyses of the prepared MoS₂ nanoparticles are shown in Figs. 3 and 4. From the SEM analysis, it is seen that the grown particles are spherical in nature with high porosity. The porosity among the clustered nanoparticles helps to degrade of organic dyes effectively. Figure 4 confirms the presence of Mo and S elements in the prepared sample.[14]

4.2 FTIR spectrum analysis

Figure 5 shows the FTIR spectrum of the prepared MoS₂ nanoparticles. There are broad absorption bands at 639 cm⁻¹, 893.39 cm⁻¹, 1402.99 cm⁻¹, and 1622.8 cm⁻¹, which are attributed to MoS₂. The band at 483.23 cm⁻¹ is due to the S–S bond and that at 931.39 cm⁻¹ is due to the S–S bond. The peaks at about 3182 cm⁻¹ belong to the characteristic bands of the O–H group.

4.3 Raman spectra analysis

The Raman spectrum (Fig. 6) of bulk MoS₂ has two prominent peaks and they are ascribed as in-plane (E_{2g}) mode located around 381 cm⁻¹ and an out-of-plane (A_{1g}) mode which is located at 397 cm⁻¹. The out-of-plane mode is due to the sulfur atoms vibrating out-of-plane, and the in-plane mode is a mixed atom vibrations of Mo and S on the opposite directions.



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Another peak observed at 391 cm^{-1} may be due to the presence of Mo_3S_4 phase discussed in the XRD.

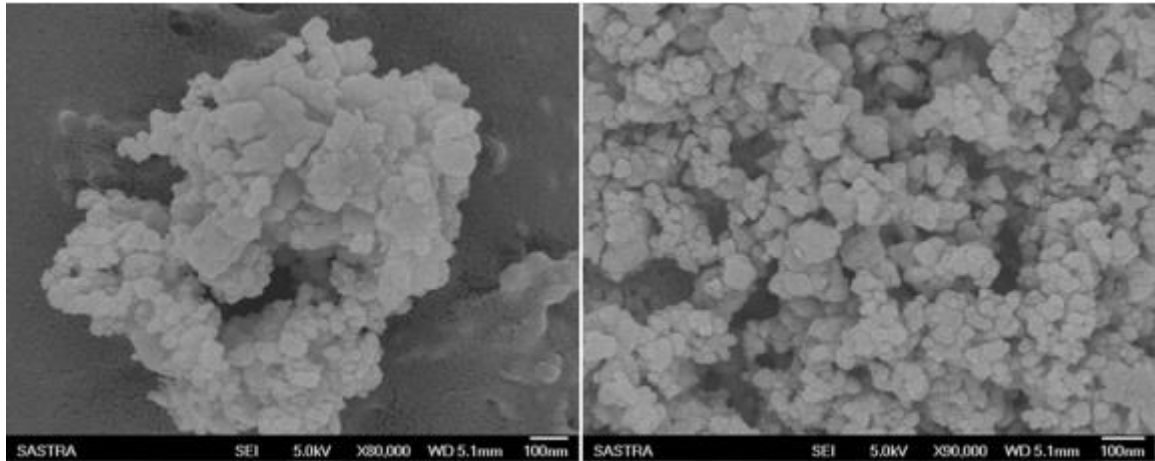


Figure 3. SEM images of MoS_2 nanoparticles

4.4 Photocatalytic studies

The dye degradation efficiency of the prepared nanoparticles has been investigated against MB and MG under the illumination of visible light. The photocatalytic dye degradation can be ascribed based on the absorption of light by the dye molecules present in the sample and also used to understand the catalytic activity of the MoS_2 nanoparticles. Figure 7 shows the absorption spectra of MB and MG dyes under the visible light irradiation at different times. It is clear from the figure that the absorbance of the dye molecule decreased (maximum peak at $\lambda=664\text{ nm}$ for MB and $\lambda=617\text{ nm}$) when the exposure time is increased. Since the concentration of the dye molecules is directly proportional to the absorption, the photocatalytic efficiency of the prepared MoS_2 nanoparticles can be calculated using the formula.

$$\eta = \frac{C_0 - C}{C_0} \times 100\% = \frac{A_0 - A}{A_0} \times 100\%$$

Where C_0 and C are the initial and reaction time concentration of the used dyes. A_0 and A are the absorption values measured using UV-visible spectrometer.

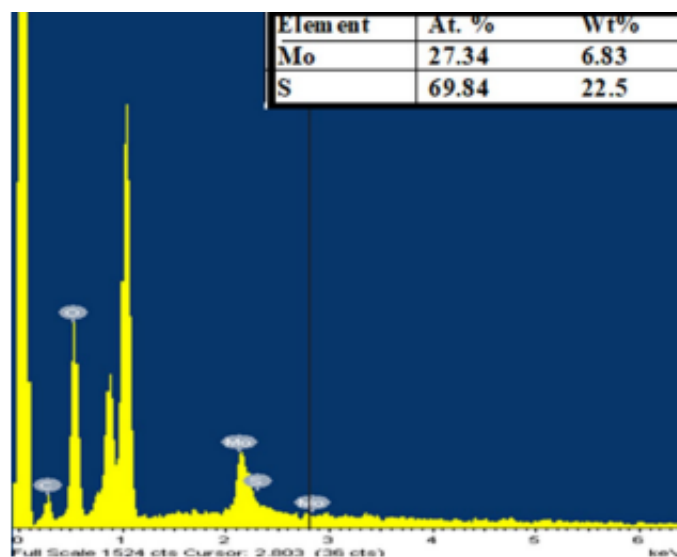


Fig. 4 EDAX spectrum of nanoparticles

Figure 8a shows the variation of C/C_0 over MoS_2 light irradiation time. It is clear from the figure that the prepared MoS_2 nanoparticles are more efficient for MB compared to MG. The degradation of dyes under light irradiation is treated as pseudo first-order kinetic reaction and this exhibits a linear variation between and irradiation time. Figure 8b shows that a near linear relationship between the kinetic data of the degradation of dyes, which can be fitted with Langmuir–Hinshelwood first-order reaction kinetic model. In addition, the reaction rate constant for MB and MG dye degradation is calculated using the following formula

$$\ln\left(\frac{C_0}{C_t}\right) = kt,$$

Where “k” is the rate constant. The calculated efficiency values (Table 2) indicate that MoS_2 can be effectively degrade both dyes. However, comparing to MG degradation efficiency, MoS_2 is more reactive on MB. This may be due to enhanced binding effect and charge transfer between the MoS_2 and MB dye molecules. Generally, the photocatalytic materials provide more active sites on their surfaces and strong absorption against the organic dye molecules. In particular, the layered materials provide easy transfer of photogenerated charges, which determines the photocatalytic characteristics of the material against the degradation of organic dye molecules. Since, the prepared MoS_2 nanoparticles possess layered nature, it provides high charge transfer for the photogenerated charge carriers along its surface and thus exhibit high efficiency of dye degradation. As compared to gC_3N_4 and TiO_2 nanoparticles prepared for photocatalytic dye degradation, MoS_2 is best suited for this purpose. The reason for this is it has a bandgap range lie in the range of visible light. However, TiO_2 has the bandgap in UV range and gC_3N_4 is exhibiting semi-metallic nature. This enables MoS_2 as a suitable candidate for visible-light photocatalytic material. Moreover, the general mechanism of MoS_2 to degrade organic dyes is follows.

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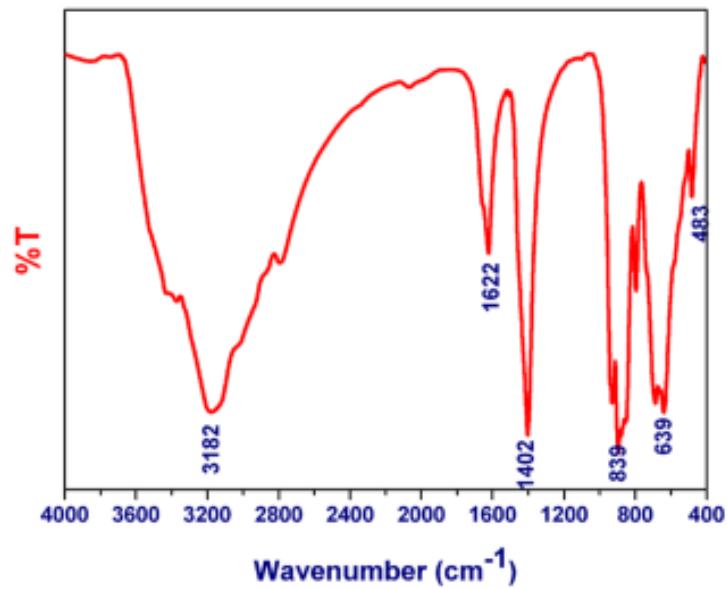


Figure 5. FTIR spectra MoS₂ nanoparticle

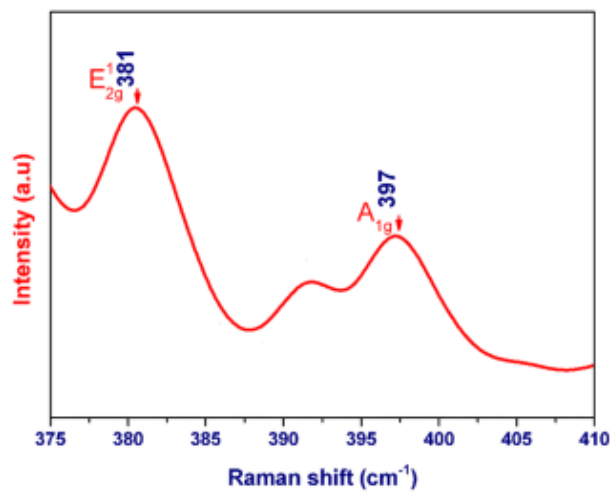


Figure 6. Raman spectra of MoS₂ nanoparticle

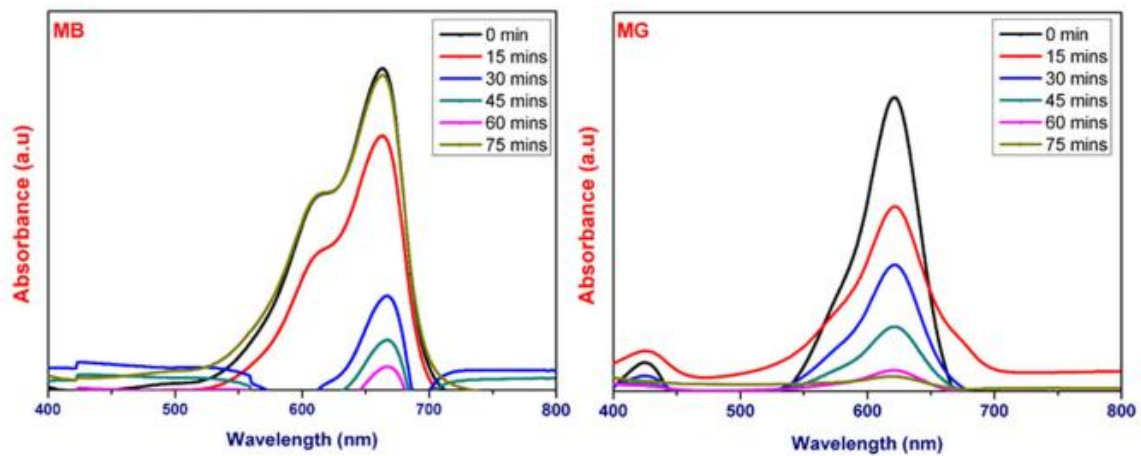


Figure 7. Photocatalytic absorption spectrum of MB and MG dyes suspended with MoS₂ nanoparticle

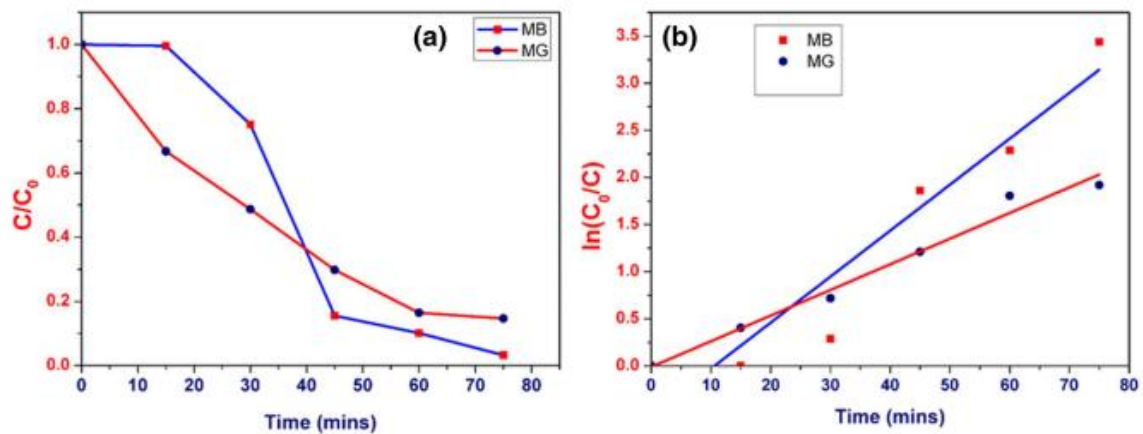


Figure. 8 a Photodegradation of a MB and MG dye, and **b** kinetic fit of MB and MG

Table 2 Degradation rate constant and efficiency of MoS₂ nanoparticles

Sample	Rate constant (k) (min ⁻¹)		Efficiency (η %)	
	MB	MG	MB	MG
MoS ₂	0.0199	0.01389	93.68	85.33

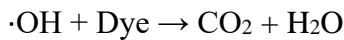
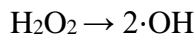
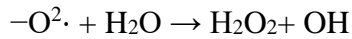
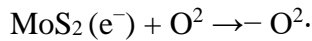
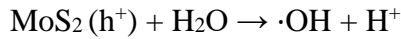
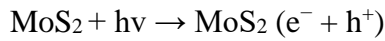
i) Absorption of light by MoS₂ nanoparticles generates electron and holes due to its low bandgap.

ii) The photogenerated electrons in the conduction band react with oxygen molecules present in the solution and form superoxide radicals (O₂⁻). These superoxide radicals react with H⁺ ions and form H₂O₂. Further, the H₂O₂ decomposes into hydroxyl radicals (•OH).

iii) Consequently, the photo-separated holes in the valence band react with water molecules and produces hydroxyl radicals (•OH).



iv) Finally, these hydroxyl radicals react with the dye molecules (MB and MG) and decompose into CO₂ and H₂O.



Density functional theory analysis

The degradation efficiency of the prepared MoS₂ nanoparticles can be explained theoretically by the following factors: (i) bandgap, (ii) effective mass and, (iii) band edge potentials. In this present work, using DFT, the above factors are measured. The optimized structure of MoS₂ nanostructure is shown in Fig. 9a. The calculated bond length between Mo and S atoms is 2.416 Å, and Mo–Mo is 3.19 Å, which are almost close to the previously reported values of 2.14 Å and 3.16 Å, respectively.

From the band structure (Fig. 9b), it is seen that the material possesses indirect bandgap (G–K) of 1.4 eV, which is well within the visible region. This is one of the required properties for visible-light-driven photocatalysis materials. The calculated projected density of states (PDOS) spectrum (in Fig. 9c) reveals the contribution of orbitals of ‘Mo’ and ‘S’ atoms over valance and conduction bands of the MoS₂ nanostructure. It is clear from the figure that the influence of the number of DOS is majorly dominated by Mo ‘4d’ and S ‘3p’ orbitals and this enables the charge transfer across the structure. However, the influence of other valance orbitals of Mo and S atoms are in-significant. For the evaluation of the photocatalytic activity, band edge potentials play an import role in the redox process. The band edge potentials play a vital role for oxidation and reduction capabilities of MoS₂ against organic pollutants. The band edge potentials of MoS₂ are calculated using the following relations

$$E_{vb} = \chi - E_e + 0.5 \times E_g$$

$$E_{cb} = E_{vb} - E_g$$

Where χ is electronegativity, E_e is the free electron energy in hydrogen scale, and E_g is the calculated bandgap. For MoS₂ the calculated band edge potentials are –0.39 V and 1.31 V for the conduction and valance bands, respectively. For an efficient photocatalytic material, it should meet the following conditions.

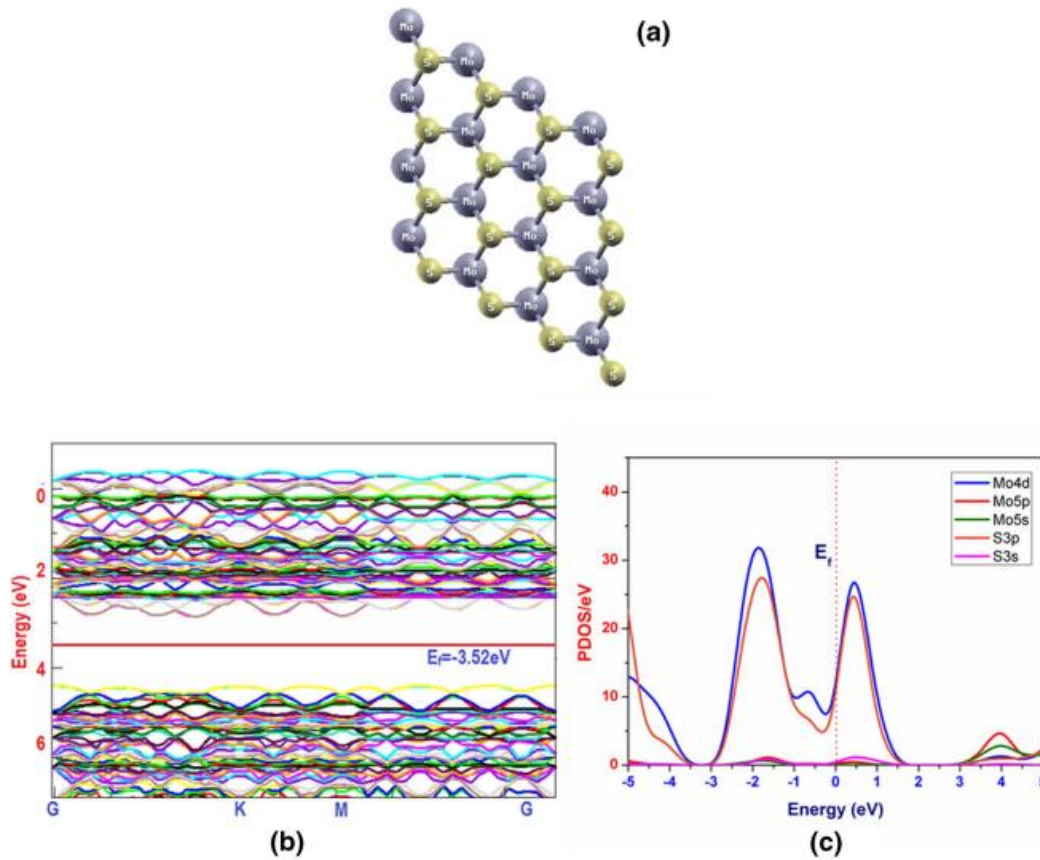


Fig. 9 (a) Optimized structure, (b) bandstructure and (c) PDOS diagrams of computed MoS₂ nanostructure

- i) Conduction band potential should > 1.23
- ii) Valance band potential should > 1.23 V

In this present study, the calculated band edge potentials are well satisfied with the above criteria, and hence a suitable candidate for visible-light-driven photocatalysis for organic pollutant degradation. Another important parameter to qualify a photocatalysis material is effective mass (m^*). For an efficient photocatalytic reaction, the mobility of the conduction band electrons should be minimum, and hence it reduces the recombination rate. Due to this, the free electrons in the valance band reach the reaction sites effectively. The effective mass, however, is directly related to the mobility of the charge carriers using the following equation

$$\mu = e \frac{\tau}{m^*},$$

Where m^* is the effective mass of the charge carriers, τ is the collision time, e is a charge of the electron and μ is the mobility. It is seen from the above relation that higher effective mass of the charge carriers results in lower mobility and hence lower recombination. The calculated effective mass of MoS₂ nanostructure is $0.42 m_e$. Based on a report by Bahers, for a best photocatalytic material, the effective mass of the charge carriers in one crystal direction should be less than $0.5 m_e$. In this present work, the calculated effective mass is $0.42 m_e$, which reduces the diffusion coefficient hence reduces the recombination. In overall, the DFT analysis results



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indicate the MoS₂ nanostructures are one of the potential candidates for photocatalytic organic pollutant degradation. (Lalithambika, et al., 2019).

5. FUTURE RECOMMENDATIONS

5.1 Conclusion

MoS₂ nanoparticles have been prepared by a simple and inexpensive method for photocatalytic dye degradation of MB and MG dyes. The XRD of the prepared nanoparticles showed the mixed phases of MoS₂ and Mo₃S₄. The EDX spectrum confirms the presence of Mo and S elements. The Raman spectrum of prepared MoS₂ nanoparticles have two prominent peaks at 383 cm⁻¹, 407 cm⁻¹ corresponds to in-plane (E_{2g}) mode and an out-of-plane (A_{1g}) mode, respectively. The photocatalytic test was performed for the prepared samples against MB, and MG dye and the efficiencies are calculated as 93.68% and 85.33%, respectively. A DFT-based calculation is performed to validate the experimental results and also to get an insight into the photocatalytic mechanism, based on bandgap, band edge potentials, and effective mass. (Lalithambika, et al., 2019).

5.2 Future Recommendations

Tailoring the nanostructure : Further research should focus on fine-tuning the nanostructure of MoS₂ materials to enhance their photocatalytic performance. This includes controlling the size, shape, and morphology of the nanomaterials. By optimizing these parameters, it is possible to enhance light absorption, charge carrier generation, and surface reaction kinetics, leading to improved overall efficiency.

Surface modification and functionalization: Surface engineering plays a crucial role in improving the photocatalytic properties of MoS₂ nanomaterials. Future studies should explore surface modification techniques, such as chemical functionalization or deposition of co-catalysts, to enhance charge separation, promote specific reactions, and increase stability. Functionalization can also help in mitigating issues such as photo corrosion and recombination of charge carriers.

Co-catalyst integration and heterostructure design: The integration of MoS₂ nanomaterials with appropriate co-catalysts or the formation of heterostructures can significantly enhance their photocatalytic activity. Future research should focus on identifying suitable co-catalysts and exploring their synergistic effects with MoS₂. Additionally, the design of heterostructures involving MoS₂ with other semiconductors can enable efficient charge transfer and broaden the absorption range, leading to enhanced photocatalytic performance.

Mechanistic understanding: To maximize the potential of MoS₂ nanomaterials in photocatalysis, it is crucial to deepen the understanding of the underlying mechanisms. Future research should employ advanced characterization techniques, such as in situ spectroscopy and ultrafast spectroscopy, to unravel the charge carrier dynamics, reaction pathways, and active sites. This knowledge will aid in the rational design and optimization of MoS₂-based photocatalysts.

Scale-up synthesis and cost-effectiveness: Large-scale synthesis methods that are reproducible, scalable, and cost-effective are essential for practical applications of MoS₂ nanomaterials in photocatalysis. Future research should focus on developing scalable synthesis techniques, such



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as hydrothermal or solvothermal methods, to produce high-quality MoS₂ nanomaterials in large quantities. This will facilitate their commercialization and widespread implementation.

Environmental impact assessment: As with any nanomaterial, it is crucial to evaluate the potential environmental impact of MoS₂ nanoparticles. Future studies should investigate the fate, toxicity, and long-term effects of MoS₂ nanomaterials in the environment. This will aid in the development of safe and sustainable photocatalytic systems.

In conclusion, future research on MoS₂ nanomaterials for photocatalysis should prioritize tailoring the nanostructure, surface modification, co-catalyst integration, mechanistic understanding, scalable synthesis, and environmental impact assessment. Addressing these aspects will accelerate the development of efficient and practical MoS₂-based photocatalytic systems for various energy and environmental applications.

5.3 Summary

MoS₂ (Molybdenum Disulfide) nanomaterials have emerged as promising candidates for photocatalysis due to their unique properties and potential applications in various environmental and energy-related processes. Here is a summary of MoS₂ nanomaterials for photocatalysis:

Structure and properties: MoS₂ nanomaterials possess a layered structure consisting of molybdenum atoms sandwiched between layers of sulfur atoms. This structure imparts excellent catalytic properties to MoS₂. Nanoscale dimensions introduce a high surface-to-volume ratio, which enhances their reactivity. MoS₂ nanomaterials exhibit a direct bandgap, enabling efficient light absorption, and they can respond to visible light, which is abundant in the solar spectrum.

Photocatalytic activity: MoS₂ nanomaterials exhibit significant photocatalytic activity in various reactions. When exposed to light, they generate charge carriers (electrons and holes) due to their suitable bandgap. These charge carriers participate in redox reactions, such as water splitting, pollutant degradation, and CO₂ reduction. Thus, MoS₂ nanomaterials serve as effective catalysts for clean energy generation and environmental remediation.

Co-catalyst and heterostructure integration: To enhance their photocatalytic performance, MoS₂ nanomaterials can be combined with other materials, such as noble metals (e.g., Pt, Au) or semiconductor nanomaterials (e.g., TiO₂, ZnO). This integration as co-catalysts or heterostructures promotes charge separation, facilitates surface reaction kinetics, and expands the absorption range, resulting in improved photocatalytic efficiency.

Mechanisms and applications: The photocatalytic mechanisms of MoS₂ nanomaterials involve light absorption, charge separation, surface reaction, and charge transfer processes. Their versatile photocatalytic activity enables applications in various fields. These include water splitting for hydrogen production, degradation of organic pollutants, carbon dioxide reduction to value-added chemicals, and solar energy conversion.

Challenges and prospects: Despite the significant progress in utilizing MoS₂ nanomaterials for photocatalysis, there are challenges that need to be addressed. These include improving quantum efficiency, enhancing stability, and developing scalable synthesis methods. Future research can focus on novel synthetic approaches, surface modification techniques, and the exploration of MoS₂-based composites to optimize photocatalytic performance.



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In summary, MoS₂ nanomaterials offer great potential as photocatalysts due to their unique structure, visible light response, and versatile photocatalytic activity. By further advancing their synthesis techniques, integration with other materials, and understanding the underlying mechanisms, MoS₂ nanomaterials can contribute to the development of efficient and sustainable photocatalytic systems for various energy and environmental applications.

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A STUDY ON ENGINEERING PROPERTIES OF DENSE GRADE BITUMINOUS MIXES WITH COAL ASH BY USING NATURAL FIBER

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ABSTRACT

Coal based thermal power plants have been a key source of power generation in India. The prime waste product of a coal thermal power plants are y ash and bottom ash. Heavy dumping of these waste products causes fatal environment pollution to air, water, and land. This research work is done to deliver the optimum use of ash namely coal ash as a mineral filler, with natural Fiber used to improvise the engineering properties of bituminous paving mixes. To strengthen the mix, slow setting emulsion coated fiber is added in varying percentage by weight of mix, with different length variations. Marshall Stability test is performed to study the Marshall characteristics and determine optimum fiber content including the optimum length of fiber.

Keywords: Bitumen, Coal ash, Fly ash, Fiber, Marshall Stability Test.

1. INTRODUCTION

1.1 Background of the Study

Pavements or highways or roads are regarded as countries backbone, upon which its upswing and progress depend on. All countries normally have a series of programs for building a new road infrastructure or emerging the existing one. Construction of both flexible and rigid pavement include a gross amount of investment to reach better performance oriented and smooth quality of pavement that will endure for long time. In India, where highways are considered as the primary function of transportation, Government of India have been investing a huge amount of money for developing the pavement construction and maintenance. A detailed engineering study may retain significant amount of investment and pavement materials, which in turn achieve a reliable performance of the in-service highway. Regarding flexible pavement, two major facts are taken into considerations i.e., pavement design and mix design. The present research study is focused on engineering property of bituminous mixes prepared from alternate or nonconventional materials.

1.2 Bituminous Mix Design

Bituminous pavement comprises of a mixture of stone chips, graded from nominal maximum aggregates size (NMAS), through the fine fraction smaller than 0.075 mm mixed with appropriate amount of bitumen that can be compacted adequately with smaller air voids and will have adequate dissipative and elastic properties. The aim of bituminous mix design is to determine the fair proportion of bitumen and aggregates fraction to yield a mixture that is effective, durable, reliable, and economical.

1.3 Types of Bituminous Mix



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Bituminous mixes are combination of mineral aggregate and binder that are mixed with their optimum value to lay down and compacted in layers for building smooth road. Mixing of bitumen and mineral aggregates are done in several ways.

1.4 Hot Mix Asphalt

Commonly known as HMA, is prepared by heating bitumen binder and moisture dry aggregate to a mixing temperature of 150 °C to 160 °C (300 °F to 330 °F) which will provide a consistent mixture to work with. Due to high temperature of the mixture it is possible to compact the mixture to its optimum air content to give better stability than others. There as on being which HMA is widely used on highly trafficked roadways such as highways, airfields, and racetracks.

1.5 Warm Mix Asphalt

Frequently known as WMA, is prepared by mixing aggregate and binder at a moderate temperature of 100 °C to 135 °C. The virgin binder is modified with foreign additives prior to mix, which will help bitumen binder to mix properly with mineral aggregate. Due to low temperature of mixing, consumption of fuel and emission of harmful gases are comparatively lower than hot mix. Not only had it improved workability, but also the low-temperature laying helps in accessing road surface much quickly.

1.6 Cold Mix Asphalt

This technique is practiced where high mixing temperature is a problem. The aggregate is blended with an emulsified bitumen (a combination of water and bitumen in a proper ratio) to a mixture that is easy to work and compact. When water evaporates from emulsion leaving back bitumen, the cold mix will, ideally, take on the properties of cold HMA. Cold mix is frequently used as a patch material on a lesser trafficked road.

1.7 Cutback Asphalt

A lighter fraction of petroleum is dissolved with bitumen binder to produce a less viscous liquid that will dissolve with the aggregate and evaporate after compaction is done. Cutback bitumen has been widely used in contradiction due to its nonpolluting characteristic and easy to work with.

1.8 Mastic Asphalt

Mastic asphalt is made by heating hard grade blown bitumen (oxidation) in a green cooker (mixer) until it has turned to a viscous liquid before it is added to aggregates. The mixture is cooked for 6- 8 hours to mature and once the mixer is ready, it is transported to the site where it generally laid in different thickness for footpath, road and for flooring or roof applications.

1.9 Hot mix Asphalt

Hot Mix Asphalt (HMA) is mixture of aggregate and bitumen that are mixed, placed and compacted at higher temperature. The three types of HMA are Dense Graded Bituminous Macadam (DBM), Stone Matrix Asphalt (SMA) and Open graded mix.

2.0 Dense Graded Bituminous Macadam (DBM)

This type of bituminous mix is a well-graded HMA with proper proportion of all aggregate fraction. It is hard and relatively impermeable. Dense-graded mixes are classified as fine-graded and coarse graded.

2.1 Stone Matrix Asphalt

Stone matrix asphalt (SMA), which is occasionally called as Stone Mastic Asphalt, is a gap graded mix, eventually developed to maximize the rutting resistance caused by heavy traffic. SMA has a high coarse aggregate fraction that interlocks to each other, to form a stone



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skeleton that resists permanent deformation. SMA is preferably used for surface courses on high volumeroads. Mineral filler sand additives are used to check the drain-down of bitumen binder during construction.

2.2 Open Graded Mixes

Unlike DBM and SMA, an open-graded mix is made-up of only stone chip sand bituminous binder. Due to absence of Fine aggregate and filler it became porous and offers surface water to drain down quickly. It is used as a drainage layer under dense-graded HMA, SMA or PCC. It has enough friction with relatively little strength than other. It is purposefully constructed with high air void that reduce road tire noise by up to 50%.

2. OBJECTIVES of THE RESEARCH

This experimental study has done to enable the most appropriate use of coal ash as nonconventional aggregate along with natural fiber (Sisal fiber) as an additive by ensuring the adequate performance result in the field of fatigue, moisture susceptibility, and creep value. Again the possible effects of fiber on bitumen mixes are also taken into consideration, and comprehensive study was done to find the optimum fiber content and fiber length that will increase the engineering property of bituminous mix.

3. SCOPE OF THE STUDY

- The significant scope of this study is to use coal ash as a fine material in HMA mix design and thus producing a good quality and smooth surface road which may be commercially acclaimed and can with stand in any possible environment condition.
- The significant scope of this study is to use coal ash as a fine material in HMA mix design and thus producing a good quality and smooth surface road which may be commercially acclaimed and can with stand in any possible environment condition.

4. RAW MATERIALS USED IN THIS STUDY

In this study following materials are taken in to consideration to prepare the bituminous mix.

- Stone chips (as coarse aggregate)
- Fly ash (as mineral filler)
- VG-30 (as bitumen binder)
- Sisal fiber (as additives)
- SS-1 emulsion (as fiber coating agent)

5. ANALYSIS

5.1 Effect of Sisal Fiber and Coal Ash on DBM mix

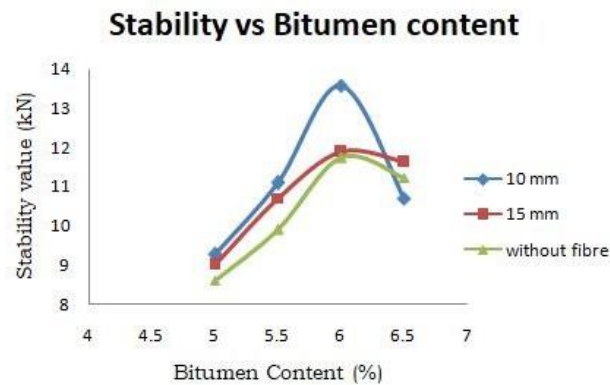


Figure 1. Variation of Stability value with bitumen content in 0.5% fiber content at different fiber length

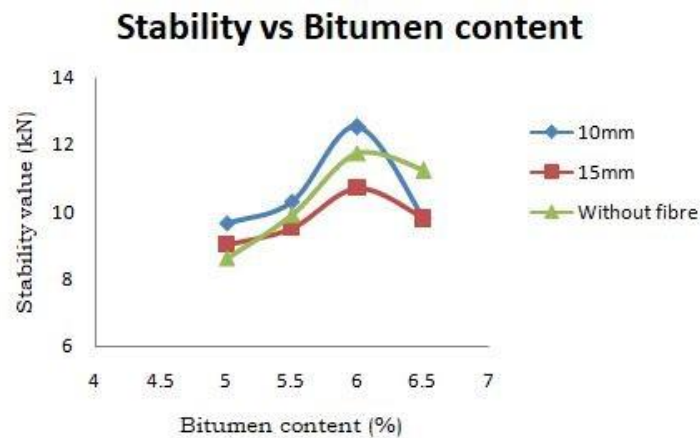


Figure 2: Variation of Stability value with bitumen content in 1% fiber content at different fiber length

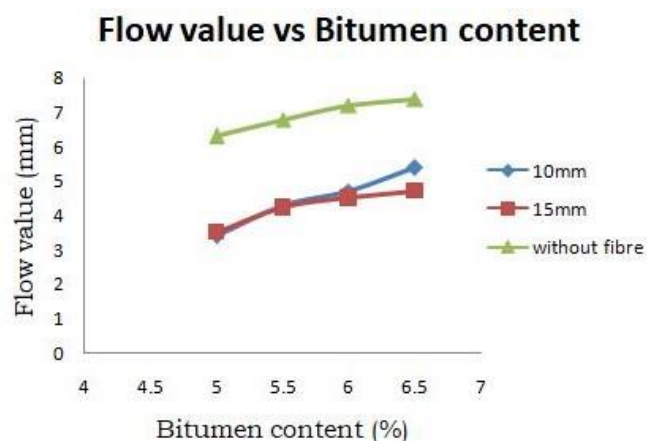


Figure 3. Variation of flow value with bitumen content in 0.5% fiber content at different fiber length

Flow value vs Bitumen content

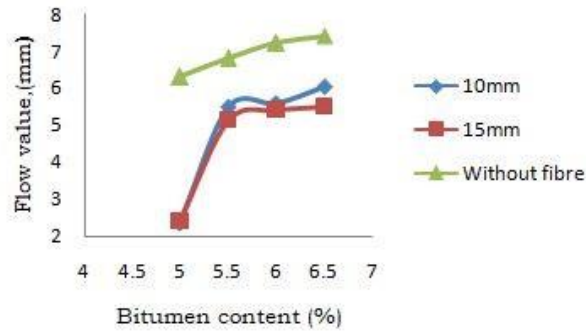
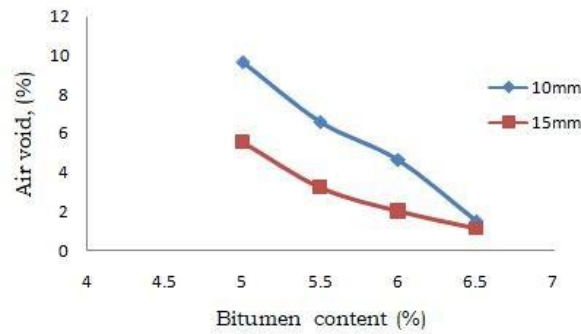


Figure 4. Variation of flow value with bitumen content in 1% fiber content at different fiberlength

Figure 5. Variation of Air Voids value with bitumen content in 0.5% fiber content at

Air void vs Bitumen content



different fiber length

Air void vs Bitumen content

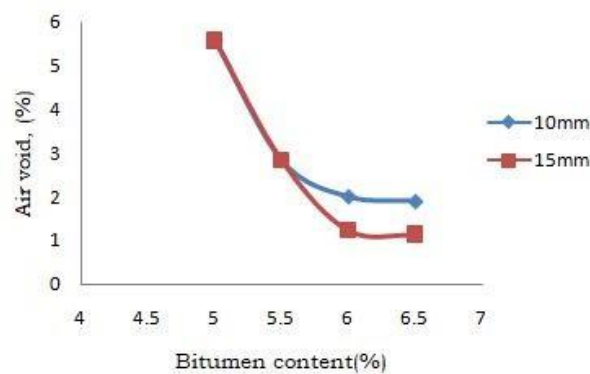


Figure 6. Variation of Air Voids value with bitumen content in 1% fiber content at different fiber length

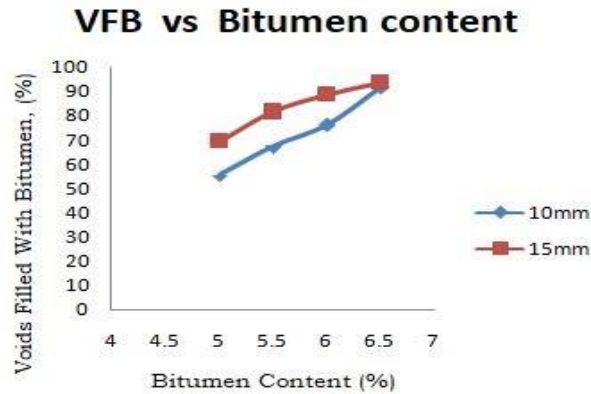


Figure 7. Variation of VFB value with bitumen content in 0.5% fiber content at different fiber length

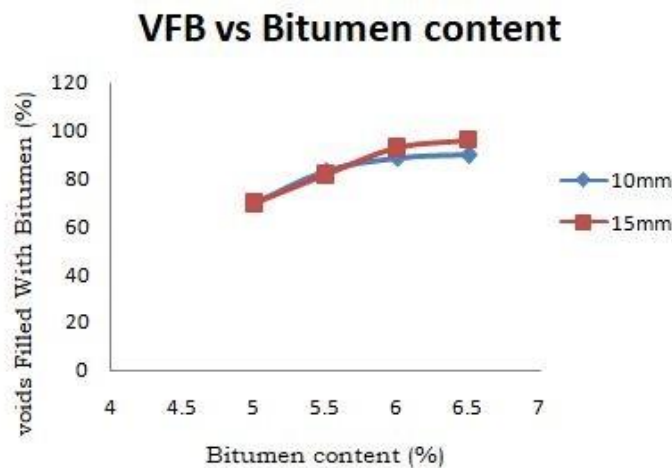


Figure 8: Variation of VFB value with bitumen content in 1% fiber content at different fiber length

6. CONCLUSIONS

- From the results of the Marshall tests it is observed that with increase in bitumen content and fiber content (both in weight and length of fiber), the stability values increase up to a certain limit and then decrease (after 6% of bitumen it decreases).
- From optimum binder content analysis, it is found that maximum stability is 13.57KN for 6% bitumen with 0.5% fiber and 10mm fiber length which is coated with SS1 emulsion.
- It is observed that maximum stability value is 13.57KN and corresponding flow value is 4.3.
- With addition of fiber, flow value decreases. With respect to bitumen content, as bitumen % increases, flow value increases when fiber is added.



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- Due to the addition of fibers increase in fiber content and length of fiber, the air voids (%) decreases.
- With increase in fiber content and fiber length, VFB increases.

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BIOLOGICAL WARFARE: A SAFE AND EFFECTIVE SOLUTION FOR CONTROLLING MOSQUITO-BORNE DISEASES IN URBAN AREAS

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ABSTRACT

This article includes several trends of Malaria in recent years. Article highlights controlling disease in urban areas can be achieved in an effective and eco-friendly way by employing biological weapons against mosquitoes. This proactive approach to urban city design promotes a healthy and safe environment for all residents, making it a smart choice. Malaria is one of the most severe diseases and has significantly impacted humans for a long time. Scientists and researchers spend decades finding treatments to cure Malaria. Fortunately, the overall trends are going in positive ways. In the year 1960, people discovered Malaria Vaccines. Literature review methods were used to research current trends. Nowadays, the development of treatment is far beyond Malaria Vaccines since researchers invented Malaria chip-disease model. In addition, the community is enhancing the prevention of Malaria for pregnant women. Before, places like Brazil, India, and Africa didn't have complete systematic prevention of Malaria, which caused a high death rate. However, as more advanced developments appear and more patrons support these poor places, Malaria cases decrease significantly. People all around the world put lots of effort into eradicating Malaria.

Keywords: Biological Warfare, Mosquito-Borne Diseases, Urban Areas.

1. INTRODUCTION

Malaria is one of the deadliest diseases caused by Plasmodium, an animal parasite. Plasmodium lives in an animal's body, then spreads to humans through Anopheles mosquitoes. Once the Anopheles mosquito attaches to the human body, the sporozoites will pass to liver cells, then they start duplicating in the cells, and Merozoites will be released. After that, they will become trophozoites and, eventually, schizonts. Schizonts repeatedly reproduce in the human body. Four types of Malaria parasites are *P. vivax*, *P. ovale*, *P. malariae*, and *P. falciparum*. Although it has been a long time since Malaria appeared, the total death caused by Malaria in 2021 is 61900. Seventy-seven percent of deaths are children, and every minute five children die due to Malaria. In 1880, a French doctor called Alphonse Laveran found Plasmodium in a Malaria patient's blood.

2. IMPACT AND CAUSES OF MALARIA

2.1 Why mosquitoes bite people: In human blood, there's a special protein that female mosquitos need to spawn. Second, carbon dioxide attracts mosquitoes. When people are breathing, mosquitoes find them. Third, they like the smell of a mixture of bacteria and sweat, and that's why mosquitos like people's ankles and feet. Unfortunately, pregnant women are more attractive than more people to mosquitos since pregnant women exhale 21% more air than



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non-pregnant women and their body temperature is higher. Researchers also find that blood type AB and O are more attractive to mosquitoes than other blood types. Children are more vulnerable to Malaria because they haven't developed complete immune systems to defend against Plasmodium.

2.2 Symptoms: After people are infected by Malaria, they may have headaches, fever, and shivering after a few days. But these symptoms are not for every patient because some people have asymptomatic infections. Asymptomatic infection is very dangerous because if patients don't get cured after 24 hours, they will get worse. Children have more symptoms than normal adults if they are infected with Malaria. Children will have gastroenteritis, encephalitis, or pneumonia followed by fever. What happened in patients' bodies when they are having fever? When they are having fever, erythrocyte schizonts release merozoites. *P. falciparum* is one of the four types of Malaria parasites, and it is the most dangerous one since it causes more complications. For children, the most common complications are CM and SMA. The symptoms of CM are coma, epilepsy, or even loss of awareness. Despite some children can be awake after 24 hours, but still, 10% of them will retain neurological sequelae, such as epilepsy.

2.3 Spreading: Malaria cannot infect from human to human, and it mainly spreads by Anopheles mosquitos. There are 400 types of Anopheles mosquitos, and 10% of them can spread Malaria. Also, the spreading depends on different areas and the types of mosquitoes. For example, tropical countries have a higher rate of Malaria infection since high temperature and moist air cause mosquitoes easier to reproduce. Some people are easier infected by Malaria than others like children under 5 and people have poor communities. Not all patients are infected by mosquitoes, some of them have congenital malaria, and *Plasmodium vivax* is the most common congenital parasite.

Species				
Stages	<i>P. Falciparum</i>	<i>P. Vivax</i>	<i>P. Malariae</i>	<i>P. Oval</i>
Ring Stage				
Trophozoite				
Schizont				
Gametocyte				

Figure 1. This picture shows 4 stages of Malaria parasite, and 4 types of Malaria parasites.

3. TREATMENTS OF MALARIA

Besides Malaria vaccines, there is a complete system of diagnosis of Malaria, such as blood testing, that shows which type of Malaria the patient gets, etc. Via blood tests, doctors can



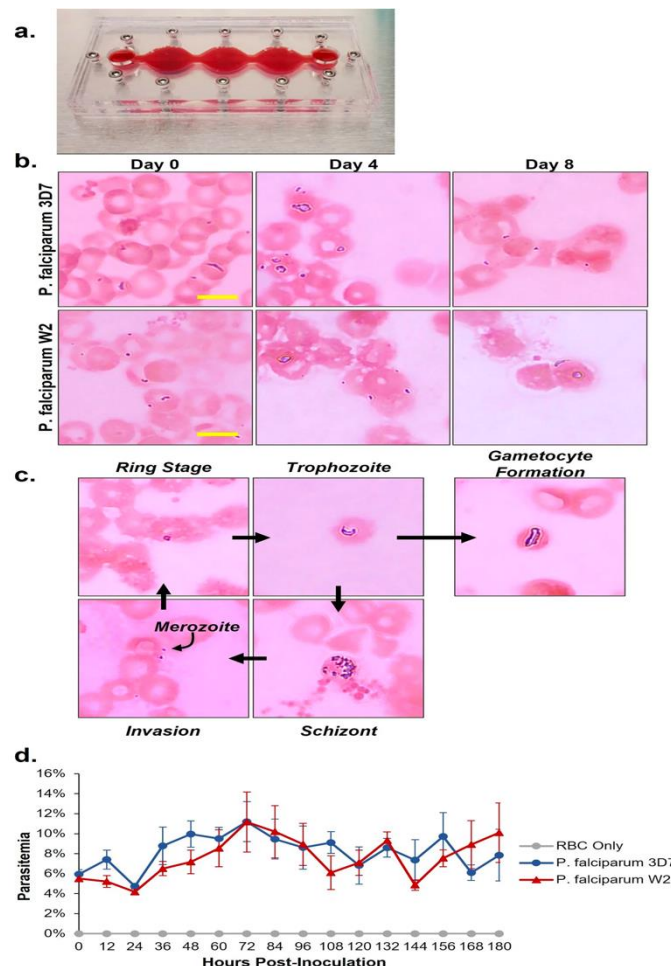
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regulate drugs depending on the characteristics of the patients, like age and symptoms. The common medicines are Chloroquine, Quinine sulfate, Hydroxychloroquine, and Mefloquine.

3.1 High Technology of Treatment: Researchers have invented a multi-function, multi-organ, serum-free system used to culture *P. falciparum*. This system simulates four human organs (liver cells, spleen, endothelial cells, and recirculating red blood cells). This malaria-on-a-chip disease model tests the efficiency of various drugs and off-target toxicity. Researchers must check the cells' viability and morphology for seven days to achieve the target. For the experiment, scientists added two strains of *P. falciparum*, the 3D7 strain, and the W2 strain; one is chloroquine-sensitive, and one is chloroquine-resistant. This result shows the 3D7 strain palindromic at day five, whereas the W2 strain reduces its level after injecting chloroquine. The experiment testifies the chip model's functions are practical since it can test both drug's effectiveness and the responses of immune organs on *P. falciparum*.



(a) is the Malaria chip-disease model, the 3 red dots are representing the simulators of liver cells, spleen cells, and endothelial cells. (b) The conditions of both *P. falciparum* W2 and *P. falciparum* 3D7 on day 0, day 4, and day 8. Clearly, the parasites decrease every 4 days, which means chloroquine is effective to cure *P. falciparum*. (c) indicates the cycle of Malaria's stages, and it includes a special staging which is gametocyte formation. Gametocytes are formed in blood cells and usually in a shape like a sausage.



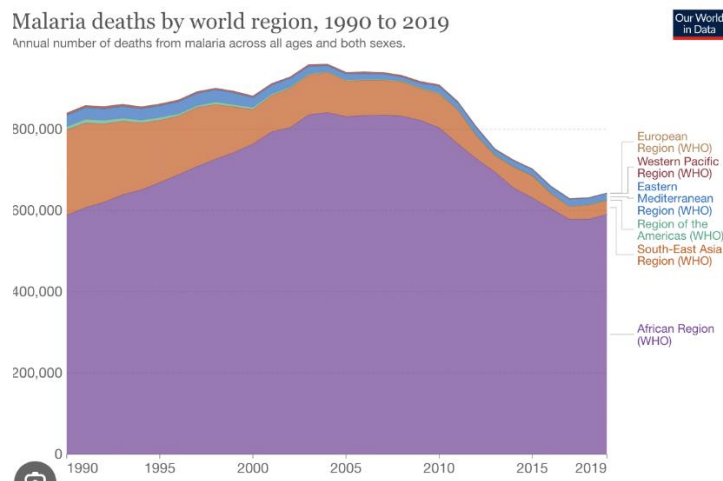
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3.2 Particular Areas: According to the 2021 World Malaria Report research, 87 countries still have Malaria risk. Places in Brazil, Africa, and India still have severe problems due to Malaria. However, in recent years, the number of deaths from Malaria has decreased significantly. The Pan America Health Organization supports treatment in America. For example, Brazil reduces Malaria deaths by 61% down and hospitalization down 84%. In addition, Honduras's Health Surveillance expands diagnostic coverage and treatment. Paraguay's National Program creates a strategy of "3T" (Testing, Treating, and Tracking). Based on the "Malaria Champions of America, Brazil, and Haiti put effort into reducing Malaria cases. From 2013 to Oct 2017, Malaria cases decreased from 8000 to 126. Not only do PAHO and HHSU work on preventing Malaria, but some investments also support defeating Malaria, for instance, Bill and Melinda Gates Foundation's strategy and "Malaria Zero" in America. Gates Foundation has donated 258.3 million dollars for Malaria vaccines and drugs, and they also have granted money for buying Mosquito nets and then sent them to poor areas.

In China, there are 60 types of Anopheles mosquitoes. Plasmodium sinensis is a special type of Malaria parasite that only appeared in China, but it's not very effective in spreading. Plasmodium sinensis is common in mountains. Another type of parasite in China is An. Anthropophagus and it emerges in Yunnan, Guizhou, and Liaoning. Researchers found An.dirus in Hainan province since 2010. China Health Organization recommends using ITNs and LLIN to prevent Malaria. During the period 1960-1979, Malaria cases increased quickly in China, and An. Minimus is the primary vector. China did have a strategy for prevention, for instance in 1983, China started to train and test. IRS and LLINs support the prevention of Malaria. Luckily, from 2000-2009, Malaria cases were reduced. To eliminate Malaria, 13 ministries and commissions established the "China Malaria Elimination Action Plan" which accelerated the elimination of Malaria cases in China. Since 2010, mosquito nets have become the most important tools for preventing Malaria. In 2020, the National Health Commission published "Administrative Measures for Preventing Re-establishment of Transmission by Imported Malaria". During the process of reducing Malaria in China, Tu Youyou, a great pharmacologist found artemisinin in 1972. In the 1960s, chloroquine was ineffective against Malaria, and lots of people dies from Malaria. She led her team to extract the antimalarial components in artemisinin by using a low boiling point solvent. Artemisinin saved a million lives in China.





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The image shows the trends of Malaria cases in different regions, the total number of cases was increasing till 2005, then it started to decrease after 2015. After that, there was an increasing trend from 2016 to 2019, but it is not serious as in 2005.

3.3 Pregnancy treatment: It is pretty dangerous for pregnant women having Malaria, especially *P. falciparum*. Malaria may harm the baby through the placenta; for example, it will cause women anemia. Today, it is very difficult to discriminate whether a person has congenital malaria or is infected by mosquitoes. In Africa, more than 13 million pregnancies were exposed to Malaria infection. To help pregnant women prevent Malaria, CHWs will send every pregnant woman the sulfoxide-pyrimethamine, a medicine that helps to prevent Malaria. 2012 WHO guidance asserted that each pregnant woman must receive three doses of preventive treatment (IPTp) o.

3. CONCLUSION

There are positive signs that the fight against malaria is yielding results, and we may see a sustained reduction in malaria cases and deaths globally by 2023. The reason for this is that there is more funding for preventive measures, better access to treatment, and innovative tools such as insecticide-treated bed nets and vaccines. Nevertheless, it's critical to stay watchful and maintain these efforts to eliminate malaria entirely. By collaborating, we can establish a healthier and safer world for everyone. In conclusion, biological weapons are a highly effective and eco-friendly way to control mosquito populations in urban areas. By using natural substances like Bti, *Metarhizium anisopliae*, and *Toxorhynchites*, we can reduce the spread of deadly diseases without harming the environment or other wildlife. It is important to use these biological weapons responsibly and in accordance with local regulations to ensure that they are used safely and effectively.

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CORROSION CONTROL WITH FURFURAL DERIVATIVES (5-(HYDROXYMETHYL) FURFURAL, AND 5-(HYDROXYMETHYL)FUROIC ACID) USING DFT

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ABSTRACT

Today, theoretical computational tools are used to predict behavior. Add corrosion inhibitors to metal surfaces to avoid the energy consumption and expense of experimental testing. This work aimed to predict the inhibitory effects of certain furan derivatives in acidic media by comparing their intrinsic antiseptic properties and behavior. The anti-corrosive properties were studied by using quantum chemical calculations. Density Functional Theory (DFT), lowest unoccupied (ELUMO) and highest occupied (EHOMO) molecular orbital energies, energy gap (ΔE), chemical hardness (η), softness (σ), electronegativity (χ), electrophilicity (ω) and nucleophilicity (ϵ) have been calculated and discussed.

Keywords: Furan Derivatives, Corrosion, DFT, Prediction.

1. INTRODUCTION

Corrosion still has a huge economic impact in most industrial countries today, accounting for about a percentage point of the gross domestic product that is why the study of the inhibition of corrosion of metals remains a fertile area for scientific research. Is for finding realistic solutions for the probable problem consequences of metals corrosion phenomena such as environmental pollution, industrial damage and so is economic loss 1.

Computer software is now becoming a widely used and trusted tool for explaining the behavior of corrosion inhibitors in different media and metal surfaces. Density functional theory (DFT) is a computational modeling method commonly used to study the intrinsic properties of molecules. For inhibitors, it is mainly used to predict chemical properties, such as the highest occupied molecular orbital–lowest unoccupied molecular orbital (HOMO–LUMO) energy gap, chemical hardness, softness, electronegativity, chemical potential, proton affinity, electrophilicity and nucleophilicity of chemical species.

In our work, theoretical studies were investigated to predict the efficiency of three selected furan derivatives: furan-2-carbaldehyde (FF1), 5-(hydroxymethyl) furfural (FF2), and 5-(hydroxymethyl) furoic acid (FF3). Firstly, the intrinsic properties such as the EHOMO–



ELUMO energy gap (ΔE), chemical hardness (η), electronegativity (χ), the fraction of electrons transferred (ΔN), total negative charges and dipole moment of FF1, FF2, and FF3 were studied by using quantum chemical calculations.

2. COMPUTATIONAL DETAILS

Employing the Gaussian 03W program package, the density functional theory (DFT) calculations were performed on the studied furfurals derivatives FF1, FF2, and FF3 in gas and aqueous phases. All molecules were geometrically optimized using the DFT/B3LYP method associated with 6-31G++ (2d,p) basis sets, which is widely used in the investigation of organic corrosion inhibitors [2]

These include the lowest unoccupied (ELUMO) and highest occupied (EHOMO) molecular orbital energies, as well as gap energy (ΔE , Equation (1)), electronegativity (χ , Equation (2)), hardness (η , Equation (3)), fraction of electrons transferred (ΔN , Equation (4)), electrophilicity (ω), nucleophilicity (ϵ) and dipole moment (μ) [53]. Furthermore, the frontier molecular orbitals (i.e., HOMO and LUMO) repartitions and 2D electrostatic potential plots of each furfural derivative were calculated and figured.

$$\Delta E = ELUMO - EHOMO$$

$$\chi = -1/2 (ELUMO + EHOMO)$$

$$\eta = 1/2 (ELUMO - EHOMO)$$

$$\Delta N = \phi - \chi/2 \times \eta$$

DFT Performances

The quantum molecular results summarized in Tables 1 and 2 aim to describe in detail the energetic and structural characteristics of the studied molecules. The quantum chemical parameters calculated using the HF/6-31G++ (2d,p), MP2/6-31G++(2d,p), and B3LYP/6-31G++(2d,p) methods for the inhibitors in aqueous and gas phases.

Table 1. Calculated quantum chemical parameters for the molecules in the gas phase (eV)

	ELUMO	EHOMO	ΔE	Energy	I	A	η	χ	ω	ϵ	ΔN
HF/6-31G++(2d,p)											
FF1	1.095	-9.673	10.768	-9284.422	9.673	-1.095	5.384	4.289	1.708	0.585	0.018
FF2	1.060	-9.322	10.382	-12,382.22	9.322	-1.060	5.191	4.131	1.643	0.608	0.034
FF3	1.031	-8.680	9.711	-23,703.52	8.680	-1.031	4.855	3.824	1.506	0.664	0.067
MP2/6-31G++(2d,p)											
FF1	0.976	-9.396	10.372	-9289.265	9.396	-0.976	5.186	4.210	1.709	0.585	0.026
FF2	0.950	-8.932	9.882	-12,388.66	8.932	-0.950	4.941	3.991	1.612	0.620	0.049
FF3	0.911	-8.513	9.423	-23,714.94	8.513	-0.910	4.712	3.801	1.533	0.652	0.072
B3LYP/6-31G++(2d,p)											
FF1	-1.751	-6.911	5.160	-9289.608	6.911	1.751	2.580	4.331	3.635	0.275	0.029
FF2	-1.649	-6.775	5.126	-12,389.13	6.775	1.649	2.563	4.212	3.461	0.289	0.052
FF3	-1.533	-6.638	5.104	-23,715.59	6.638	1.533	2.552	4.085	3.270	0.306	0.077

Table 2. Calculated quantum chemical parameters for the molecules in the aqueous phase (eV).



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	ELUMO	EHOMO	ΔE	Energy	I	A	η	χ	ω	ϵ	ΔN
HF/6-31G++(2d,p)											
FF1	0.983	-8.952	9.935	-9343.37	8.952	-0.983	4.967	3.984	1.598	0.626	0.050
FF2	1.006	-8.857	9.863	-12,460	8.857	-1.006	4.932	3.925	1.562	0.640	0.056
FF3	1.031	-8.680	9.711	-23,861	8.680	-1.031	4.855	3.824	1.506	0.664	0.067
MP2/6-31G++(2d,p)											
FF1	0.868	-8.829	9.697	-9343.87	8.829	-0.868	4,848	3.980	1.634	0.612	0.051
FF2	0.886	-8.680	9.567	-12,460.8	8.681	-0.886	4.783	3.897	1.588	0.630	0.061
FF3	0.910	-8.513	9.423	-23,861.9	8.513	-0.910	4.712	3.801	1.533	0.652	0.072
B3LYP/6-31G++(2d,p)											
FF1	-1.704	-6.698	4.994	-9343.87	6.698	1.704	2.497	4.201	3.534	0.283	0.056
FF2	-1.852	-6.479	4.627	-12,460.8	6.479	1.852	2.314	4.165	3.749	0.267	0.068
FF3	-1.992	-6.210	4.217	-23,861.9	6.210	1.992	2.109	4.101	3.988	0.251	0.090

HOMO and LUMO Energies and Derived

The highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) of a chemical molecule is important in defining its reactivity. Compounds FF1, FF2, and FF3 show a significant contribution of p orbitals at the cyclic level (furan ring), consisting of an aromatic ring with five atoms including oxygen atoms [3], [4].

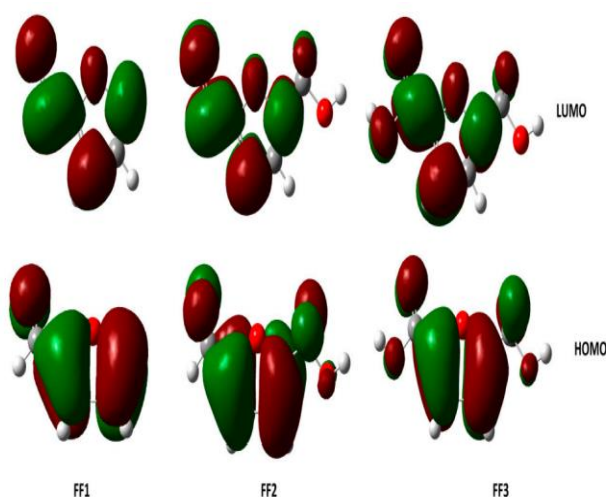


Figure 1. The HOMOs and LUMOs of inhibitor molecules in the gas phase using the DFT/B3LYP/ 6-31++G(2d,p) method.

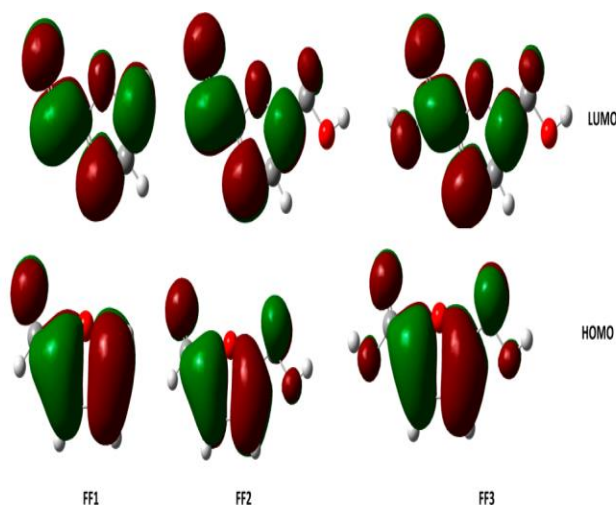


Figure 2. The HOMOs and LUMOs of inhibitor molecules in the aqueous phase using the DFT/B3LYP/ 6-31++G(2d,p) method

3. CONCLUSION

Finally, different basis sets were used for DFT calculation to compare and evaluate the corrosion inhibition efficiency of three furan derivatives, namely furan-2-carbaldehyde, 5-hydroxymethylfurfural, and 5-hydroxymethyl furanic acid. Theoretical vibrational studies confirm that all these compounds have different functional groups (aldehyde and carboxyl). Neutral and split forms are optimized and checked. The results calculated using DFT show that FF3 has a smaller electronegativity value compared to FF2 and FF1. Therefore, in terms of the reactivity of these compounds, FF3 is more inclined to act as an electron donor.

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COMPARISON OF THE ENGINEERING PROPERTIES OF DGB MIXES WITH COAL ASH USING NATURAL FIBERS

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ABSTRACT

Coal based thermal power plants have been a key source of power generation in India. The prime waste product of coal thermal power plants is y ash and bottom ash. Heavy dumping of these waste products causes environmental pollution to air, water, and land. The research work is to determine the use of ash namely coal ash as a mineral filler, with natural fibers like coconut coir fiber, jute fiber to improvise the engineering properties of bituminous paving mixes. To strengthen the mix, fiber is added in varying percentage by weight of mix. Marshall Stability test is performed to study the variation in Marshall characteristics of the mixes when fiber % is varied.

Keywords: Bitumen, Coal Ash, Y Ash, Marshall Stability Test, Coconut Coir Fiber, Jute Fiber.

1. INTRODUCTION

Pavements or Highways or Roads are regarded as country's backbone, upon which its upswing and progress depend on. All countries normally have a series of programs for building a new road infrastructure or emerging the existing one. Construction of both flexible and rigid pavement include a gross amount of investment to reach better performance oriented and smooth quality of pavement that will endure for long time. In India, where highways are considered as the primary function of transportation, Government of India has been investing a huge amount of money for developing the pavement construction and maintenance. A detailed engineering study may retain significant amount of investment and pavement materials, which in turn achieve a reliable performance of the in-service highway. Regarding flexible pavement, two major facts are taken into considerations i.e., pavement design and mix design. The present research study is focused on engineering properties of bituminous mixes prepared from alternate or nonconventional materials.

Bituminous pavement comprises of a mixture of stone chips, graded from nominal maximum aggregates size (NMAS), through the fine fraction smaller than 0.075 mm mixed with appropriate amount of bitumen that can be compacted adequately with smaller air voids and will have adequate dissipative and elastic properties. The aim of bituminous mix design is to determine the fair proportion of bitumen and aggregates fraction to yield a mixture that is effective, durable, reliable, and economical.

2. Objectives of the research work:



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1. This experimental study is focused to enable the most appropriate use of coal ash as nonconventional aggregate.
2. The adequate performance in the field of fatigue, moisture susceptibility, and creep value with addition of natural fibers (Coconut coir and jute fiber) as an additive is to be studied experimentally.
3. The possible effects of fiber on bitumen mixes are taken into consideration, and comprehensive study is done to find the optimum fiber content.

3. SCOPE OF THE STUDY

1. The scope of this study is to use coal ash as a fine material in HMA mix design.
2. Utilization of non-conventional materials like coal ash and natural fibers (Coconut coir and jute fiber) by using with different percentages to determine the engineering properties like:
 - Marshall stability value.
 - Marshall ow value.
 - Air voids content.
 - Voids filled with bitumen (VFB).

4. LITERATURE REVIEW

Ali N et al. (1996) conducted experimental study to observe the outcome of y ash on the mechanical properties of bituminous mixtures. Also evaluated the significant effect of using y ash in improving performance characteristics and modifying pavement distress. In this study, four types of specimens with various percentage of y ash fractions were studied. The properties such as permanent deformation, resilient modulus, creep, and fatigue were calculated at three different temperatures. Moisture induced damage tests were also carried out to assess moisture induced damage. The pavement performance was predicted by VESYS model. Results indicated that y ash as a mineral filler can be used to increase resilient modulus characteristics and stripping resistance. The addition of y ash did not reduce field performance of asphalt concrete mix in terms of rut depth and serviceability index but with the increase in temperature the sum of surface cracking also increased in the pavement.

Vasudevan (2013) conducted a test on Performance characteristics of Bottom ash in HMA (Hot Mix Asphalt). The objective of this research is to use the Bottom ash as aggregates in sub bases, bases, and pavement layer. This research is motivated with three parts objectives for evaluating the stability of bitumen mixture which are prepared form certain percentage of bottom ash using Marshall Method, determining physical characteristics of bottom ash when it was mixed with bitumen and evaluated the improvement of engineering properties of the Marshall cube in terms of texture and appearance. Based on the experimental results, the sample with bottom ash is superior to conventional samples in terms of stiffness, strength, and the sample ow. Subsequently, the pavement will become stronger and can withstand if loaded high traffic load. However, there are drawbacks with the usages of coal bottom ash as mineral filler where the air void content increased which cause in reduction of density in the mixture.



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Hadiwardoyo and Pranowo (2013) studied that the failure at the surface layers of road is due to the change in temperature and the load of the traffic. Structural. An experiment on short coconut fibers in bitumen mix is performed. With various percentage of coconut fibers ranging from 0.5% to 1.50% with the increment of 0.25%. The fiber size was also varied with 5mm, 7.5mm, 10mm, and 12.5 mm. The bitumen characteristic with coconut fibers is tested. From the results obtained in Marshall properties test it is found that the Marshall stability increased by 10-15%, when 0.75% of fiber content and 5 mm of fiber length was added by weight of the mixture. It is also observed that with the addition of fiber in bitumen, change the bitumen property with a lower penetration value. Debashish (2007) studied the effect of indigenously available sisal fiber on SMA and BC mixture. Sisal fiber is considered as an additive for BC mix and stabilizing agent for SMA mix. Fiber content varied from 0% to 0.5% by weight of total mix whereas binder content was varied from 4% to 7%. For mineral filler y ash, is used as it has shown satisfactory result at the initial stage of experiment. For the performance test the BC and SMA mixes were subjected to various test such as Drain down test, Static Creep test and Static Indirect Tensile Strength Test. From the Marshall properties test it was observed that addition of fiber helps to improve the Marshall Stability and indirect tensile strength, it also reduces the Drain down. It is observed that the indirect tensile strength of SMA mixture is better than BC mixture. From Marshall test it is found that the optimum binder content for BC and SMA were 5% and 5.2% respectively whereas optimum fiber content were 0.3%. Kumar et al. (2007) studied the performances of the SMA mixture modified with crumb rubber modified checkonce binder (CRMB) and low viscosity binder coated jute fibers. The performance of SMA mixture were assessed by conducting two different methods of drain-down, durability test, moisture susceptibility test, fatigue life tests and rutting test. The characteristic of modified SMA prepared with coated jute fiber and with other patented fibers are compared. From the test observation it is concluded that fiber content of 0.3% by weight of the mix improve the Drain-down property of the mix.

Zeng and Ksaibati (2003) examined the moisture induced damage of bitumen mixtures comprising bottom ash. Eight bitumen mixtures made with one type of bitumen cement, two kinds of aggregate, three sources of bottom ash, and lime additive were estimated by using the principles written in AASHTO T283. The addition of lime considerably upgrade the moisture induced damage of the asphalt mixtures as measured by TSR (recommended TSR value should be greater than 80%). Asphalt mixtures with the stone chips had higher indirect tensile strength (ITS) values as compared to the limestone aggregate in dry condition. The addition of lime or bottom ash did not significantly change ITS values. Putman et al. (2004) studied the use of waste fiber in stone mastic asphalt mixture (SMA). Waste tire and carpet fibers are used as an additive to stabilize the excessive drain-down due to relatively high air void in SMA. Also studied the performance characteristics of SMA mixtures prepared with waste tire and carpet fibers. A comparative study has been done between SMA modified with tire and carpet fibers and with other mixes prepared with cellulose and polyester. From the observation it is found that the sample containing carpet and tire fibers, were effective in stopping unnecessary drain-down of the SMA mix.

5. MATERIALS USED IN THE STUDY

In this study following materials are taken for the preparation of bituminous mix.

- Stone chips (as coarse aggregate)

- Fly ash (as mineral filler)
- VG-30 (as bitumen binder)
- Jute fiber (as additives)
- Coconut coir fiber (as additives)

6. EXPERIMENTAL SETUP

6.1 Marshall Stability Test:

- The Marshall stability and flow test provides the performance prediction measure for the Marshall mix design method.
- The stability portion of the test measures the maximum load supported by the test specimen at a loading rate of 50.8 mm/minute.
- Load is applied to the specimen till failure, and the maximum load is designated as stability.
- During the loading, an attached dial gauge measures the specimens plastic flow (deformation) due to the loading.
- The flow value is recorded in 0.25 mm (0.01 inch) increments at the same time when the maximum load is recorded.

6.2 Specimen Preparation:

- Approximately 1200gm of aggregates and filler is taken for the preparation of specimen.
- Bitumen is heated to a temperature of 160°C with the first trial percentage of bitumen (say 5 by weight of the mineral aggregates).



Figure 1. Marshall Stability Test

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- The mix is placed in a preheated mould and compacted by a rammer with 75 blows oneither side.
- Without any disturbance keep the mould at 24 hours.
- Then again keep the mould for 30 minutes in water and then weight the mould.
- Keep the mould into the Marshall equipment and test the mould. Then, note down theMarshall stability value and Flow value.
- The weight of mixed aggregates taken for the preparation of the specimen may be suitablyaltered to obtain a compacted thickness of 63.5+/-3 mm.
- Vary the bitumen content in the next trial by +1 and repeat the above procedure.
- The fibers are cut into specified lengths of 10mm.
- Required quantity of bitumen VG-30 and fiber pieces are added to the aggregate mixtureand thoroughly mixed.

In this experiment, the resistance to deformation of a Marshall cylindrical specimen of DBM mixture is measured. The specimen is loaded diametrically at a deformation rate of 50 mm/min. Here are two major features of the Marshall method of mix design are:

6.3 Stability and flow values



Figure 2. Specimen preparation

6.4 Voids analysis

- Different samples are prepared using Jute and Coconut coir fiber as additives for 5%,1%,1.5% in bitumen content.
- Marshall stability for bituminous mix is defined as the maximum resistance carried by specimen at a standard temperature of 60⁰C. The flow value is recorded when the specimen deformed under maximum.



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Figure 3. Bitumen moulds



Figure 4. Specimen samples



Figure 5. Observation of readings

For the moulds prepared, the above are calculated and the effect of fiber is studied and checked whether each parameter satisfies the limits are not.

7. ANALYSIS OF RESULTS AND CONCLUSIONS

7.1 Parameters used in the Study

Some of the parameters considered for this study are:

- Marshall stability value.
- Marshall flow value.
- Air voids content.
- Voids filled with bitumen (VFB).

7.1.1 Theoretical Specific Gravity of Bitumen Mix (G_t)

$$G_t = \frac{W_1 + W_2 + W_3 + W_4}{\frac{W_1}{G_1} + \frac{W_2}{G_2} + \frac{W_3}{G_3} + \frac{W_4}{G_4}}$$

where,

- W₁ = percent by weight of coarse aggregate in total mix.
- W₂ = percent by weight of fine aggregate.
- W₃ = percent by weight of weight of filler.
- W₄ = percent by weight of bituminous binder in total mix.
- G₁ = Specific gravity of coarse aggregate.
- G₂ = Specific gravity of fine aggregate.
- G₃ = Specific gravity of filler.
- G₄ = Specific gravity of bituminous binder.

7.1.2 Bulk Specific Gravity of the Bitumen (G_m)



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The bulk specific gravity or the actual specific gravity of the mix G_m is the specific gravity considering air voids and is found out by

$$G_m = \frac{W_m}{W_m - W_w} \quad (1)$$

where,

W_m = Dry weight of sample.

W_w = Wet weight of sample.

It is obtained by measuring the total weight of the mix and its volume. Volume is determined by measuring the dimensions of the sample or for better accuracy it can be measured by the volume of water it displaces. However, while the sample is immersed in water, some water may be absorbed by the pores of the mix.

7.1.3 Air voids

It is the total volume of the small pockets of air between the coated aggregate particles through-out a compacted paving mixture, expressed as a percent of the bulk volume of the compacted paving mixture. The amount of air voids in a mixture is extremely important and closely related to stability, durability, and permeability.

7.1.4 Volume of Bitumen

It is the volume of bitumen binder in the mix that has been absorbed into the pore structure of the aggregate. This volume is not accounted for the effective bitumen content.

7.1.5 Voids in Mineral Aggregates

The total volume of voids in the aggregate mix (when there is no bitumen) is called Voids in Mineral Aggregates (VMA). In other words, VMA is the volume of intergranular void space between the aggregate particles of a compacted paving mixture. It includes the air voids and the volume of bitumen not absorbed into the aggregate. VMA is expressed as a percentage of the total volume of the mix.

$$VMA = V_A + V_B \quad (2)$$

where,

V_A = Air voids in the mix.

V_B = Volume of bitumen.

7.1.6 Voids filled with Bitumen (VFB)

VFB is the voids in the mineral aggregate frame work filled with bitumen binder. This represents the volume of the effective bitumen content.

where,

V_b = Volume of bitumen.

VMA = Voids in Mineral Aggregate.

7.1.7 Effect of coal ash on DBM

The percentage of bitumen content is varied as 5%,6%,7% by weight. Coal ash is taken as filler. The variation in properties is tabulated below:



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Table 1. Effect of Coal ash on DBM mix

Bitumen (%)	Dry Weight (g)	wet Weight (g)	Thickness (cm)	Diameter (cm)	Marshall Stability (kN)	Flow Value (cm)	Air Voids (%)	VFB (%)
5	1261	755	6.3	10.1	5.49	4.3	5.962	67.62
6	1268	760	6.3	10.1	5.71	4.8	5.61	68.33
7	1276	765	6.3	10.1	7.73	5.3	4.90	71.72

7.1.8 Marshall Stability Value

Marshall stability measures the maximum load sustained by the bituminous material at a loading rate of 50.8 mm/minute. The variation of marshall stability value with bitumen content is illustrated in Fig 6.

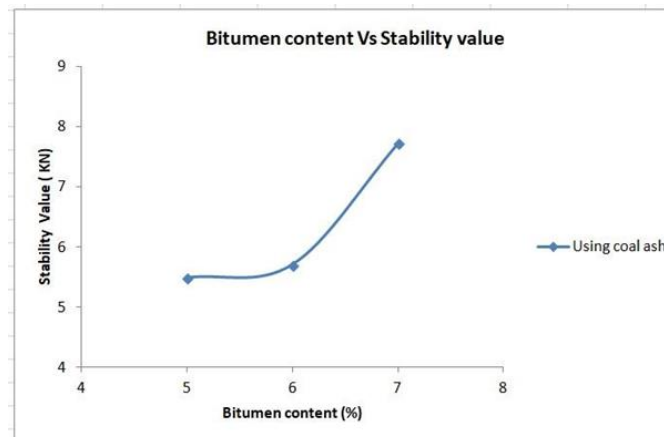


Figure 6: Marshall Stability Value

It is observed that the stability value increases with increase in bitumen content from 5% to 7%. The Marshall stability value is obtained for 7% bitumen and is 7.73 kN.

7.1.9 Marshall Flow Value

The flow value refers to the vertical deformation when the maximum load is reached. The flow value variation with bitumen content is shown in Fig 7. It is observed that as the Bitumen increases, the flow value increases.

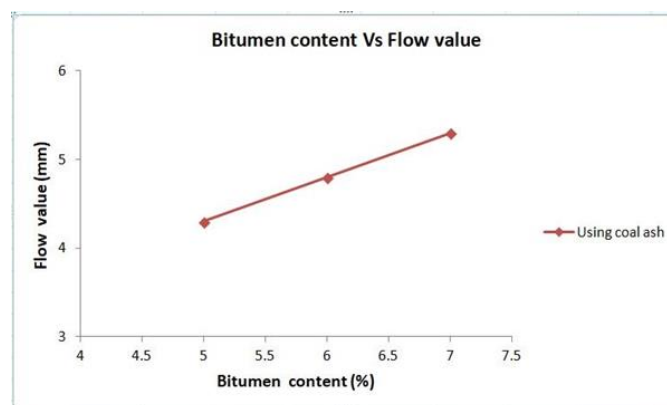


Figure 7: Marshall Flow Value

7.1.10 Air Voids

The amount of air voids in a mixture is extremely important and closely related to stability, durability, and permeability. Fig 8 represents the air voids (%) variation with bitumen content.

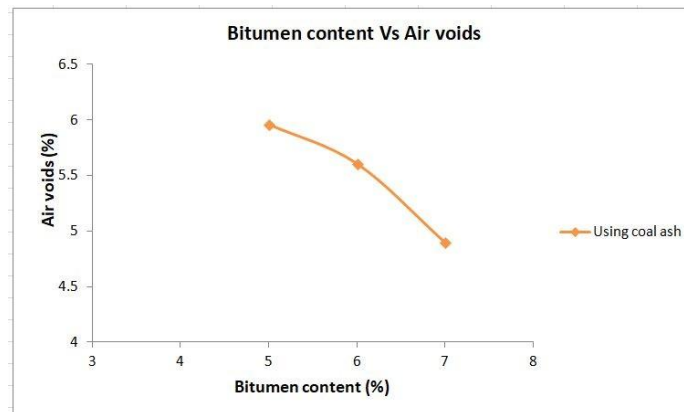


Figure 8. Air voids

It is observed that the air voids % decreases with increase in bitumen content (in %). The value of air voids is 4.90% obtained for 7% bitumen content.

7.1.11 Voids filled with bitumen

VFB is inversely related to air voids and hence as air voids decreases, the VFB increases. The decrease of VFB indicates a decrease of effective bitumen film thickness between aggregates, which will result in higher low-temperature cracking and lower durability of bitumen mixture since bitumen perform the filling and healing effects to improve the flexibility of mixture.

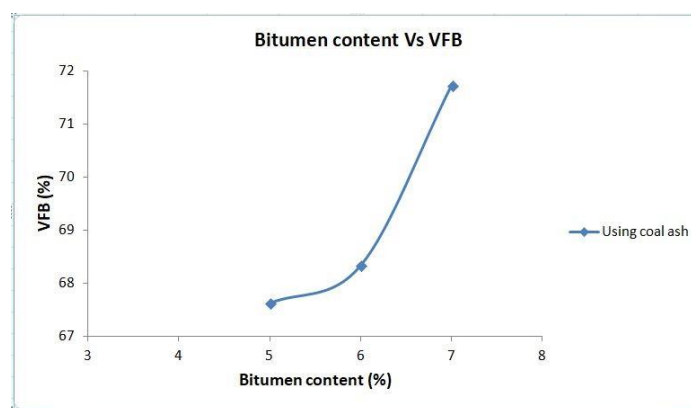


Figure 9. Voids Filled with Bitumen (VFB)

It is observed that the VFB values increases with increase in bitumen content (in %). The value of VFB value is 71.72% obtained for 7% bitumen content.

7.2 Effect of Coal Ash and Jute Fibre on DBM mix

In order to enhance the engineering properties of bitumen content, jute fibers are used as additive. Jute fiber is added in 0.5% ,1%,1.5% by weight for every bitumen



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content(5%,6%,7%).Table 5.5,5.3,5.4 indicate the variation in the engineering properties considered for study.

Table 2. Effect of 0.5% of jute fiber and coal ash

Bitumen (%)	Dry Weight (g)	wet Weight (g)	Thickness (cm)	Diameter (cm)	Marshall Stability (kN)	Flow Value (cm)	Air Voids (%)	VFB (%)
5	1266	750	6.3	10.1	5.59	3.2	5.84	69.72
6	1278	765	6.3	10.1	7.14	3.5	5.69	71.13
7	1290	775	6.3	10.1	7.85	4.2	4.90	78.35

8. CONCLUSIONS

- For 7% bitumen content and 1.5% of fiber content (by weight), the marshall stability value is more for coconut coir fiber (13.04kN) compared to jute fiber (12.25kN).
- It is inferred from the experimental results that the flow value is within the limits of (2-4mm) when the bitumen content is 5% and the fiber content is 0.5%.
- Excessive air voids in the mixture results in cracking and too low air voids may induce plastic flow. Here the experimental results show that the air voids % decreases as the fiber content increases. But maximum values of air voids satisfying the permissible limits (3-5%) for different bitumen content and fiber content is obtained for coconut fiber.
- Air voids percentage and VFB values are inversely proportional, it is concluded from tests that with increase in fiber content, VFB value increases for both fibers. But the limits of (75%-85%) is maximum satisfied for coconut fiber content in mixture.
- Among the two natural fibers used, based on marshall mix design, coconut coir fiber gives best results which are within required specified limits for 7% Bitumen content and 0.5% fiber content by weight.

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EFFECTS OF FIELDWORK STRATEGY ON SENIOR SECONDARY SCHOOL STUDENTS ACADEMIC PERFORMANCE AND INTEREST IN GEOGRAPHY, KATSINA, NIGERIA

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ABSTRACT

This study investigated the Effects of Fieldwork Strategy on Senior Secondary School Students Academic Performance and Interest in Geography, Katsina State, Nigeria. Three research objectives, three research question were raised and three null hypotheses were formulated and tested at 0.05 significant level. The study used quasi experimental and control group design involving pre and posttests. The target population for the study covered 2,251 senior secondary school year II students in the study area. A total number of 106 students from two intact classes of SS II were purposively selected and used as sample of the study. One school were selected as the experimental group, while the other one served as the control group. The instruments were validated by experts in science education and psychology. The instruments with reliability coefficients of 0.6 and 0.8, namely Geography Achievement Test and Geography Interest Questionnaire were used for data collection. Research questions were answered descriptively using mean and standard deviation while null hypotheses were tested inferentially using t-test, Mann Whitney U-Test and Kruskal Wallis H-Test were used. Findings of the study revealed that there was significant difference in the academic performance of students exposed to the Fieldwork strategy and lecture method in favour of experimental group. There was also significant difference in the interest of students exposed to the same strategy and those taught using lecture method. Gender difference exist in the performance and interest of students exposed to Fieldwork strategy. On the bases of the findings, the study recommended that the use of Fieldwork Strategy in teaching geography in school should be encouraged by State Ministries of Education through training of teachers in form of seminars and workshops on how to use Fieldwork in teaching periodically. Similarly, Katsina State Ministry of education should ensure adequate monitoring of teachers when using Fieldwork Strategy for improving achievement and interest towards school subjects with immediate effect.

Keywords: Fieldwork Strategy, Academic Performance, Interest.



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1. INTRODUCTION

Geography is considered as the study of the earth's environments and peoples, and the interactions between them. Geography as an academic subject, is geared towards teaching the interrelationships among phenomenon on the earth's surface and those in the atmosphere (Abdulkarim, 2010). It enables students to explore and understand the relationship between human beings and the earth through the study of space, place and environment. Geography, as a school subject is a multidisciplinary subject that cuts across a wide range of subject areas. Basically, the subject entails the study of the natural environment and its relationship with man, hence the nomenclature of physical and human Geography (Mutum, 2019). Human geography is a major sub discipline within the wider subject field of geography. It is referred to as the study of man's reciprocal relationship with his environment. It looks at the impact and behavior of people and how they relate to the physical world. Areas of human geography includes; population, settlement, urban, medical, agriculture, resource, industry and cultural geography (Parvez, 2018).

Worldwide, the environment offers diversity and variety that are stimulating and exciting places in which to live and learn. Bruce (2011), stated that environments are significant as they help learners to develop sensitivity to their immediate locality and by this understanding strengthened their own sense of identity. He adds that they also help them keep to their own reality as an important element in their schooling. Geography is one of the activity-based school subjects. The effectiveness of teaching in school can be measured by examining the method of teaching applied by teachers and the performance of students in school examination. In the measurement of students' academic performance in geography, as a school subject, various tasks are undertaken within and outside the classroom; the effectiveness of these activities lie in the instructional methods used by the teacher (Silas et al., 2016).

Instructional methods refer not only to the ways, approaches, procedures and kinds of activities which teachers and students engage in the interactive process with a view to inducing, inspiring and facilitating learning for the purpose of accomplishing instructional objectives. Teaching methods also include the utilization of appropriately selected curriculum resources materials, content and learning experiences, motivational strategies, educational field-trips, evaluative and implementation strategies, the application of learning theories and the demonstration of knowledge of educational psychology and aspects of developmental psychology in the teaching-learning process (Okam, 2019).

A variety of methods and approaches are advocated for teaching. Most of these methods and approaches are in use in the Nigerian school's system and each of them provides something useful and worthwhile to a capable and enthusiastic teacher. None of the methods and approaches is error-proof; each of them is associated with a number of advantages and disadvantages (Okam, 2019). These include: Lecture method, Demonstration method, Discovery method, Project method, Problem-solving method, Heuristic method, Inquiry method, Discussion method, Laboratory method, Fieldwork method among others.

The term Fieldwork, is seen to be the "active engagement with the external world"; whether every activity described as fieldwork fits the criteria of "active engagement" is debatable (Mohammed, 2016). Amosun (2016) stated that, Fieldwork includes fieldtrips, field teaching, field research or field camps or indeed "any arena or zone within a subject, where outside the constraints of the four walls of classrooms' settings, supervised learning can take place via



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firsthand experience”. Fieldwork in the context of this study is the art of taking students to the field to gather data on population, settlement and agriculture. In spite of all the views that geography is based-learned in a field, most geography teachers are having a view that teaching physical aspects of the subject such as rivers and their features, weathering and their features, soil and soil erosion, mountains, deserts and their various landforms and the like are the only areas where fieldwork is required in teaching geography. In human geography, topics such as settlements and their types, transportation system, industries, agriculture, population among others are traditionally taught in the classroom settings using traditional teaching strategies (lecture among others).

Geography students are expected to be exposed to different aspects of their curriculum outside their classrooms. This is because geographers study the totality of the earth’s phenomena. The phenomena they study are outside the classroom. Geography entails integration of fieldwork to study natural phenomena. “The environment is the laboratory of geographers” (Amosun, 2016). Its practical aspects and their dimensions are carried out there. One of the objectives of teaching geography is helping learners understand their immediate environment as well as that of the universe. This cannot happen in rigidly planned classroom activities where the teacher and text books are the only sources of information. Nabors et al., (2009) disclosed that school learning should be authentic and connected to the world outside of school, not only to make learning real but also to develop in to a learner’s ability to apply knowledge in real-world settings.

Majority of geography teachers are not using fieldwork teaching strategy as noticed in many Secondary Schools in this country (Awolusi, 2012; Falana, 2015; & Amosun, 2016). Some teachers are only exposing their students when teaching some topics under physical geography such as rocks, Action of running water, Flooding, Soil erosion and so on. It is difficult to see a teacher organizing a fieldwork while teaching human geography topic such as population, settlement, trade, tourism and so on. Amosun, (2016) in his work titled “Making Secondary School Geography come Alive in Nigeria: A case for fieldwork in Oyo State” found that a whooping majority of students from five secondary schools in Ibadan never participated in fieldwork and field report writing. Teachers and schools hardly get their students engaged in fieldwork. This indicates that fieldwork is not fashionable among them. Katsina State, where Baure Zonal Education Quality Assurance is located may not be exempted from this anomaly.

Academic Performance refers to the display of knowledge attained or skills developed by students in the school's subject usually designed by test scores or by marks assigned by the teachers which can either be low or high (Yakubu, 2016). The performance of candidates in the West African Examination Council (WAEC) in Nigeria is becoming poorer every year (Ezema, 2014; Salisu, 2015; & Yakubu, 2016). The WAEC chief examiner's report (2017) noted a decline in performance of Geography students over the previous years. An analysis of students result in geography in the National Examination Council of Nigeria (NECO) for a period of five years is presented in Table 1.1



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Table 1. Candidates' Performance in Geography (SSCE) 2015-2019, Nigeria

Year	No. Sat	No. Passed (A1-C6)	%	Passed (D7-D8)	%	Failed (F9)	%
2015	711,689	163,438	22.96	361,620	51	149,877	21
2016	674,686	153,613	22.77	460,333	68	32,401	5
2017	703,316	345,921	49.18	317,648	45	33,027	5
2018	671,991	432,239	64.32	206,905	31	28,010	4
2019	431,230	297,495	68.99	112,489	26	19,689	5

Source: (National Examination Council of Nigeria, 2020).

The result presented in Table 1.1 actually revealed a steady decrease in the number of students that sat for the examination and an increase in the percentage of students with credit and pass and a decrease in percentage failed, but the percentage passed and failed is still a source of worry, hence the need to improve on the teaching strategies employed in the schools in order to improve students' performance, as poor teaching method and unqualified teachers are some factors highlighted out as problems affecting students' performance (Obasi, 2011).

Interest in this study is a feeling of curiosity or concerned of subject, topic, (in this case, population, settlement and agriculture) that make attention towards it, Salisu, (2015) seen interest as "a psychological state of engagement, experienced in the moment and also a predisposition to engage repeatedly in particular ideas, events, or objects over time". Interest simultaneously diversifies one's experience and focuses his experience; leading him to pay attention to only certain things and not to some other things that tend to stimulate the person's attention. In recent years researchers have begun to build a science of interest, what makes things interesting, and how we can cultivate interest in ourselves and in others.

Gender has remained a debating issue and has also remained relevant in education because it has been linked to performance and participation in certain profession. Evidence from research findings indicate gender gap achievement in favour of males (Ezema, 2014; & Silas Et'al, 2016), while some revealed that gender is not a factor in teaching and learning (Amosa, 2013; Kabirat, Et'al, 2016; and Wada, 2015). This generated a gap and justifies the need to determine the extend gender as a variable influenced student's interest and performance in the study.

It is against this background that the researcher intends to investigate the effect of fieldwork and inquiry strategies on secondary school geography students' academic achievement and Interest in Baure Zonal Education Quality Assurance.

2. STATEMENT of THE PROBLEM

Poor academic performance of secondary school student in Geography (WAEC Chief Examiners Report 2019) has been linked to poor Teacher's performance in terms of accomplishing the teaching task, which have been attributed to instructional strategy. The problem of poor performance to a large extent has been attributed to ineffective teaching employed by geography teachers especially traditional lecture method which is largely dominated by teacher talk and chalk (Ezema, 2014; Salisu, 2015; & Yakubu, 2016).

Most Nigerian secondary school geography teachers still use the Lecture approach in teaching human geography, especially in Baure Zonal Education Quality Assurance. Empirical studies



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had highlighted some intervention measures that could stimulate the study of geography, like games, simulations, peer methods and fieldwork. Unfortunately, these had been in the areas of Physical aspects of Geography. These create a gap and the need to examine the effect of fieldwork and inquiry strategies on students' performance and interest among senior secondary school geography (human aspect).

However the problem of not employing the activity based teaching strategies like Fieldwork and Inquiry in teaching human geography in most Nigerian secondary schools has made the learning of human geography concept difficult. This worrisome state of affairs applies largely in Baure Zonal Education Quality Assurance of Katsina State, where human geography is taught largely by traditional lecture method with no attempt at practical approach suggested by NERDC (2014). In addition, in utilizing these methods, teachers considered the cognitive, aspect of learners and neglect the affective aspect (interest). There is a need therefore to provide an alternative teaching strategy which will hopefully incorporate cognitive, affective and psychomotor domains of students like the use of fieldwork and inquiry strategy. It is on this basis that, the research investigated the Effect of Fieldwork and Inquiry strategies on Secondary Schools Geography Students' Academic Performance and Interest in Baure Zonal Education Quality Assurance (ZEQA), Katsina State.

3. THEORETICAL FRAMEWORK of THE STUDY

This work is based on the constructivist approach to learning emanated from the works of Bruner (1966) and Piaget (1973) (Dewey, 2012). The theory in reaction against the largely lecture based method of instruction which have significant limitation recognizes that the best way to learn is by having students construct their own knowledge instead of having someone to do it for them. It is a learner-center approach that emphasizes the importance of individual activity constructing their knowledge and understanding with guidance from the teacher. In the constructivist view, teachers should not attempt to simply pore information in to children's mind. Rather children should be encouraged to explore their world, discover knowledge, and reflect and think critically with careful monitoring with meaningful guidance from the teacher (Jia, 2010). Fieldwork teaching strategy can best suit this assertion.

Scientists and philosophers like Dewey (1916), Piaget (1973), and Vygotsky (1978) have interpreted constructivism according to their own experience. In relation to that, the conclusion is that the learners' knowledge is their own life, their style and their life is an experience they get. Therefore, the teaching and learning process must be related to the practical real world so that the classroom is designed and shaped in such a way that teacher and students can share their knowledge and experience actively. The theory equally advanced that learning is an active process of creating meaning from different experiences with the teacher as a guide to help them along the way. This is the basis of constructivist learning theory.

Therefore a constructivist teacher creates a friendly environment for learning in which students can become more engaged in interesting activities (like fieldwork) that encourage and facilitate learning. The teacher guides students as they approach problems, encourage them to work in groups, to think about issues and questions, support them with encouragement and advice as they tackle problems, adventures, and challenges that are rooted in real life situations (Zhou & Brown, 2017). Teacher's role thus, is mainly to facilitate learning and cognitive growth.

As the father of constructivism theory, Piaget constructed a major principle in his constructivism theory. The main principle in Piaget's theory is that knowledge must be built by



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students as the active creator of that knowledge. This means that students must be active in all their learning activities; they should be able to pick up and dig new information and process it according to their needs. They are not expected to be passive. Piaget's cognitive theory of learning is referred to as "stage theory" of cognitive development. According to Piaget as cited by Zhou and Brown, (2017), children develop knowledge by inventory or constructing reality out of experience and thus mix their observation with their ideas about how the world works. Piaget (1973) believed that for people to learn, they must assimilate and accommodate. He opines that at each stage of development people use a distinction underline logic or structure of reasoning to guide their thinking. Geography is a natural and practical subject which is taught both in the classroom and in the natural environment. When geography teachers take out students on fieldwork outside the school environment for the purpose of teaching the students, it gives them the opportunity to meaningfully construct knowledge and understand the material while guiding their learning.

4. OBJECTIVE of THE STUDY

The study was guided by the following objectives to:

1. Determine the effect of fieldwork strategy on secondary school Geography students' academic performance in human geography in Baure Zonal Education Quality Assurance.
2. Find out the effect of fieldwork strategy on secondary school student interest towards human geography.
3. Determine the effect of fieldwork and strategy on gender interest among secondary school students in human geography.

5. RESEARCH QUESTIONS

The following research question were formulated to guide the research.

1. What is the difference in the mean scores of secondary school students taught human geography using fieldwork strategy and their counterparts taught the same concept using lecture method?
2. What is the difference in the mean interest score of secondary school students taught human geography using fieldwork strategy and their counterparts taught using lecture method?
3. What is the difference in the mean interest score of male and female secondary school geography students exposed to fieldwork strategy?

6. RESEARCH HYPOTHESES

The following null hypotheses were formulated to guide the research.

- H₀₁**. There is no significant difference in the mean scores of secondary school students taught human geography using fieldwork strategy and their counterparts taught the same concept using lecture method
- H₀₂**. There is no significant difference in the mean interest score of secondary school students taught human geography using fieldwork strategy and their counterparts taught using lecture method



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H₀₃. There is no significant difference in the mean interest score of male and female secondary school geography students exposed to fieldwork strategy.

7. RESEARCH DESIGN

The study utilized pre-test, post-test quasi-experimental and control group design. The study has two groups; one experimental (EG) and one control (CG). Before treatment, the two groups were pre-tested (O₁) to ensure selection of schools with comparative abilities. The experimental group were exposed to instructional treatment using fieldwork (X) for a period of six weeks. Control group were taught using traditional lecture method. The two groups were post-tested (O₂) using the same instruments in pre-test.

The population for this study consists of all Senior Secondary two (SSII) students offering Geography in Baure Zonal Education Quality Assurance. There are twelve (12) Senior Secondary Schools with a population of two thousand two hundred and fifty-one (2,251) Geography students with a total number of nine hundred and eighty-five (985) male Students and one thousand two hundred and sixty-six (1266) female students.

The sample of this study covered a total number of 106 SSII students selected from two public senior secondary school offering geography in the study area. The two schools are GSSS Karkarku, and GSSS Fago. The schools are separated by not less than 20kilometers to minimize interaction effect. The choice of 106 students is in line with central unit theorem which prescribe that minimum of 30 participants is adequately enough to form a sample in an experimental study of this nature. In addition, Ker linger (1975), Tukman (1980) and Kajuru & Ado (2012) stated that in research of this nature, 10-15% of the entire population can be used as a sample. In each school intact class of SSII were sampled and used for the study. Details is presented in table 3.2

Table 3.2. Sample of the Study

Schools	Status	Male	Female	Total
A	Experimental Group.	27	24	51
B	Control Group.	32	23	55
	Total	59	47	106

The instruments for this research is Geography Performance Test (GPT) and Geography Interest Questionnaire (GIQ). The GPT instrument consists of thirty (30) items test adapted from West African Senior School Certificate Examination (WASSCE) conducted by the West African Examination Council (WAEC) from 2015 to 2019. All the 30 questions adapted from this instrument, which are objective (multiple choice) items in human geography with four options (A-D) out of which only one option is correct to the items, are based on the topics selected from SS II geography syllabus. The topics selected are; Population, Settlement, and Agriculture. These items measure objectives in the blooms cognitive domain of educational objectives.

Table 3.3. Table of Specification for GAT construction

S/N	Topic	Weight	K	C	A ₁	A ₂	S	E	Total
1	Population	20%	1	1	1	1	1	1	6



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2	Settlement	40%	4	3	2	1	1	1	12
3	Agriculture	40%	4	3	2	1	1	1	12
	Total	100%	9	7	5	3	3	3	30

Source: Adapted from Obeka (2013).

Key: K = Knowledge, C = Comprehension, A₁ = Application, A₂ = Analysis, S = Synthesis, E = Evaluation.

The Geography Interest Questionnaire (GIQ) is a 25 items interest inventory questionnaire adapted from Salisu, (2015) to determine the interest of students between and after treatment on concepts of human geography. The items were developed using Likert, (1970's 4-point rating scale involving strongly Agree (SA); Agree (A); Disagree (D); and Strongly Disagree (SD). Each option carries weight in the order of priority from four to one in positive interest responses and from one to four in negative interest on Human geography concepts by simply ticking one of the four options that suit their interest.

In order to determine the extent to which the instruments can measure the Academic Performance of Students in Human Geography, the GPT are securitized by the members of supervisory team for this study and five lecturers (Three from science and vocational education and two from Geography) in Umaru Musa Yar'adua University, Katsina. A copy of the developed items was submitted to each Science Education expert for validation. GIQ was validated by panel of three qualified experts with PhD. qualification in the field of psychology in Umaru Musa Yar'adua University Katsina. The scores of the students obtained from the pilot testing were analyzed using Cronbach Alpha and Spearman Rank Order Correlation where the common inter-item correlation coefficient *r* is obtained at 0.6 and 0.8 indicating that the instruments have consistency of the items, thus the instruments is said to be reliable for this study.

Data collection procedures begin with introducing the researcher and research assistants to ministry of education and secondary schools to be used in the study by means of introductory letter. Immediately after introduction, the researcher explains to the respondents the purpose of the study and the need for cooperation. Pretest was then administered before treatment.. The procedure for the research treatment is in four phases. The data collected were subjected to analysis at two different levels, VIS: the research questions were answered by using Mean and Standard Deviation. The hypotheses were tested at 0.05 alpha level using SPSS Package Version 25.1 as follows:

8. RESULTS

RQ1: What is the difference in the mean scores of secondary school students taught human geography using fieldwork strategy and their counterparts taught the same concept using lecture method?

Table 4.1. Mean and Standard Deviation of Academic Performance of Experimental I and Control Group

Variable	N	Mean	SD	SE	Mean D/F
fieldwork strategy	51	20.94	4.59	0.64	9.69
Lecture Method	55	11.25	2.94	0.39	



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Table 4.1 shows that experimental group has a mean of 20.94 and Standard Deviation of 4.59, while the mean of control group is 11.25 with standard deviation of 2.94 and a mean difference of 14.7. This shows that geography students taught human Geography using fieldwork strategy achieved higher academically, by mean score of 20.94, than their lecture group counterpart with mean score of 11.25.

RQ2: What is the difference in the interest score of secondary school students taught human geography using fieldwork strategy and their counterparts taught using lecture method?

Table 4.4. Mean Rank Interest Scores of the Subjects in the Experimental I and Control Group

Group	N	Mean Rank	Sum of Rank	Mean Difference
Fieldwork strategy	51	79.94	4077.00	
Lecture Method	55	28.98	1594.00	50.96
Total	106			

The Table 4.4 showed the change in interest of the subject toward Geography in experimental I and control group. From the Table, the mean rank value of 79.94 was obtained in experimental group I with sum of ranks of 4077.00. While in the control group, a mean rank value of 28.98 with a sum of ranks of 1594.00 was obtained. Difference in the mean rank signifies difference in the interest ability of the subject in geography due to exposure to fieldwork Strategy and lecture method. This shows that group taught human geography using Fieldwork strategy developed higher interest in Geography than group taught using lecture method as revealed in their mean rank score.

RQ3: What is the difference in the mean interest score of male and female secondary school geography students exposed to fieldwork strategy and inquiry method?

Table 4.8. Mean Rank Interest Scores of the Subjects in the Experimental Groups

Group	N	Mean Rank
Male Fieldwork	27	60.78
Female Fieldwork	24	54.38
Total	51	

The Table 4.8 showed the change in interest of male and female students toward Geography in experimental I and II groups. From the Table, the mean rank value of 60.78 was obtained among male students in experimental group I; the mean rank value of 30.98 was obtained among male experimental group I and the mean rank value of 47.61 was obtained among female experimental group II.

H₀₁. There is no significant difference in the mean scores of secondary school students taught human geography using fieldwork strategy and their counterparts taught the same concept using lecture method

Table 4.9. Results of t-test Analysis of Performance Scores of the Subjects in the Experimental and Control Groups

Variable	N	Mean	SD	T	DF	P	decision
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Fieldwork strategy	51	20.94	4.59				Sig
Lecture Method	55	11.25	2.94	13.01	104	0.01	

*Significant at $p \leq 0.05$ level of significant

Table 4.9 shows that the t-value computed is 13.01 and the p-value of 0.01 is observed at degree of freedom of 104. Since the p-value of 0.01 is less than the alpha value, there is a significant difference in the academic performance of the subjects in experimental and control group. Therefore, null hypothesis that states that there is no significant difference in the academic performance scores of geography students taught using Fieldwork Strategy and those taught the same concept using lecture method is rejected.

H₀₂. There is no significant difference in the interest score of secondary school students taught human geography using fieldwork strategy and their counterparts taught using lecture method?

Table 4.12. Mann-Whitney U-test Rank Interest Scores of the Subjects in the Experimental I and Control Group

Group	N	Mean Rank	Sum of Rank	Man-Whitney U-test	P	Decision
Fieldwork strategy	51	79.94	4077.00	54.000	0.01	Sig.
Lecture Method	55	28.98	1594.00			

*Significant at $p \leq 0.05$ level of significant

From the Table Mann-Whitney U observed is 54.0 and the p-value observed was 0.01. Since the p-value of 0.01 is less than alpha value of 0.05, there is significant difference in the interest ability of the subject in geography and hypothesis is rejected.

H₀₃. There is no significant difference in the mean interest score of male and female secondary school geography students exposed to fieldwork strategy and inquiry method?

Table 4.16. Kruskal-Wallis H-Test of interest among male and female students taught human geography using fieldwork, inquiry and lecture method.

Groups	N	Mean Rank	Sum of Rank	H-Value	P	Remark
Male Fieldwork	27	60.78	4077.00			
Female Fieldwork	24	54.38	3200.00			
Male inquiry	26	30.98	1594.00	16.99	0.01	Sig.
Female inquiry	19	47.61				

*Significant at $p \leq 0.05$ level of significant

The result in Table 4.14 shows that the Kruskalwallis observed was 86.64 and the p-value observed was 0.01 which is less than alpha value. Since the p-value of 0.01 is less than 0.05, there is significant difference in the Interest change among male and female students in the experimental groups, the null hypothesis was rejected.

9. SUMMARY of THE FINDINGS

From the result presented in this study, the summaries of the major findings are:



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1. Significant difference exists in the mean scores of secondary school students taught human geography using fieldwork strategy and their counterparts taught the same concept using lecture method.
2. Significant difference exists in the interest score of secondary school students taught human geography using fieldwork strategy and their counterparts taught using lecture method.
3. There is significant different in the academic performance score of male and female secondary school students taught human geography using fieldwork strategy and those exposed to inquiry strategy.

10. DISCUSSION of FINDINGS

Significant difference exists in the mean scores of secondary school students taught human geography using fieldwork strategy and their counterparts taught the same concept using lecture method. This is supported by Ezema (2014), Silas et al, (2016), Omakaadejo, (2015), Yakubu, (2016). Ezema, (2014)'s finding reveals that Students exposed to Fieldwork performed significantly better than those exposed to the conventional lecture method. This finding gains further support from the work of Yakubu (2016) on effectiveness of Field based teaching strategy on students' Interest, Retention performance in climate change. The finding revealed that there is significant difference in the academic achievement of students exposed to Field based teaching strategy over the lecture method. Also Patrick (2010), investigated effects of field studies in learning outcome in Biology, The major findings of the study showed; a significance difference in process of science scores between pre-test and post-test of field trip students; a significance difference in process of science scores between students exposed to field trip experiences and these who were not exposed: a significant difference in Biology achievement test scores between students exposed to field trip experiences and these who were not; and a strong correlation between process of science score and Biology achievement score;

Also, in harmony with this findings, Nkereowajiro (2014), conducted a study on the impact of student's field trips on Academic performance in Agricultural science in selected secondary schools in Rivers state. The findings revealed that Field trip enhances knowledge of Agricultural processing methods, improves farm product utilization and contributes to species improvement and genetics. The performance level of student's senior secondary school III examination and students' overall performance in O' Level examination certificate in Agricultural science in Secondary Schools in Rivers state improved significantly ($P < 0.05$). Silas et al, (2016) on effect of fieldtrip strategy on senior secondary school students' Academic Achievement in Geography in Numan Educational Zone, Adamawa State, Nigeria. The findings of hypothesis on Academic achievements of students taught Geography using fieldtrip strategy and conventional lecture methods revealed that students who were exposed to field trip strategy had better scores in Geography than those who were taught using conventional method.

The finding comes contrary with Abul, (2007) who examined the effect of fieldwork teaching method on students' achievement in environmental education contents, in senior secondary school geography. The null hypothesis was that there is no significant difference ($p < 0.05$) in the mean academic achievement between high and low ability students in environmental education units of geography. What this implies is that, both the high and low ability groups performed well and are homogeneous in achievement. Significance difference exist in the



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interest score of secondary school students taught human geography using Fieldwork Strategy and their counterparts taught using lecture method.

This finding is in agreement with that Yakubu, (2016); Ezema, (2014); Salisu (2015); and Silvanus and Silas, (2017). Result of studies conducted by Yakubu (2016) on the effect of field-based teaching strategy on interest, retention and performance in climate change among secondary school students in Anchau, shows that students taught geography using Field-based Strategy displayed greater interest in the Climate Change concept of geography than lecture group. This is also in harmony with Ezema, (2014)'s findings. The result of the data analysis indicated that, the effect of fieldwork on students' interest was significant. This finding is also supported by Salisu, (2015) who investigated impact of Animated Media Strategy on Students' Academic Achievement, Retention and Interest among Secondary School Geography Students in Weather Concepts revealed a significant difference in interest among subject taught using Animated Media Strategy and those exposed to lecture method. Subject in the experimental group shows high positive interest than subject in the control group. The difference in the interest observed can be attributed to the use of innovations in teaching experimental group as stated by Neumann et al, (2011).

There is significant different in the academic achievement score and interest of male and female secondary school students taught human geography using fieldwork strategy and those exposed to lecture method. This finding is in harmony with those of authority such as Ezema, (2014) and Silas et al, (2016) who in their separate studies in various discipline found that gender was significant in Students Academic Achievement and Interest. Silas et al, (2016) findings on effect of fieldtrip strategy on senior secondary school students' Academic Achievement in Geography in Numan Educational Zone, Adamawa State, Nigeria, revealed a significant difference between male and female students in experimental group. The difference in the achievement was in favor of the male students. Also, Ezema, (2014) findings revealed that gender was significant factor in students' overall achievement and interest in map reading geography. Silvanus and Silas, (2017) findings also indicate that the male chemistry students achieved higher than their female counterparts.

These findings come contrary with those of authorities such as Amosa, (2013), Salisu, (2015), Yakubu, (2016), and Usman, (2010) who in their separate studies in various discipline found that the application of instructional treatment on a mixed gender school population improves the academic achievement of students irrespective of gender. Amosa (2013) also affirmed that the gender of the learners is not a factor in teaching and learning: male students taught using community resources did not perform better than female students who were also exposed to the community resources. Salisu, (2015) revealed that male students taught Weather concepts using Animated media strategy did not differ significantly from their female counterparts. Also, Yakubu, (2016), found no significant difference in the academic achievement between male and female students taught Climate Change using Field based teaching strategy. In addition, Usman (2010), opines that outdoor laboratory method enhances academic achievement of students in spite of their gender.

11. CONCLUSION

Based on the findings of this study, the study concluded that Fieldwork Strategy appears to have a strong record of success in enhancing students' academic performance. Students exposed to Fieldwork Strategy performed significantly better than those taught Human Geography by



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means of Lecture method. In terms of interest, Fieldwork strategy is better than Lecture method. Gender difference exist in the Performance and Interest of students exposed to Fieldwork Strategy. Female students exposed to Fieldwork Strategy performed better than Male students. Teachers at Senior Secondary Schools can explore the potentials of Fieldwork Strategy in order to improves students' Academic Performance and Interest in Human Geography Concepts.

12. RECOMMENDATIONS

Based on the findings of this study, the researcher recommends that:

1. The use of Fieldwork Strategy in teaching geography in school should be encouraged by State Ministries of Education through training of teachers periodically using seminars and workshops to teachers on how to use Fieldwork in teaching with immediate effect.
2. Katsina state ministries of education should ensure adequate monitoring of teachers when using Fieldwork Strategy for improving achievement and interest towards school subjects.
3. The Teacher Training Institutions and professional bodies such as NTI and STAN, to organize a special re-training, workshops, and seminars to geography teachers on how to use fieldwork strategy.

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RISKS PERCEPTION OF PUBLIC TRANSPORTATION SYSTEMS DURING PUBLIC HEALTH EMERGENCIES; A CASE STUDY OF PRE- AND POST-COVID-19 ERA IN NIGERIA

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ABSTRACT

The paper investigated commuters' trip behavior and risk perception with public transportation during and after the onset of the COVID-19 spread. The study adopted a mixed research design approach, using both qualitative and quantitative data. Quantitative data was acquired through an online and offline cross-sectional survey created through Google forms and printed hard copies, while qualitative data was sought through telephone interviews. The study revealed a change in modal choice from bus/shuttle to non-conventional modes such as motorcycles. More so, the pandemic has unprecedented impacts on sustainable mobility. Therefore the study recommends the development of sustainable mobility futures that can address the impacts of public health emergencies in public transportation in developing countries.

Keywords: Commuters Differentials, Risks Perception, Public Transportation, Transportation Planning, Coronavirus, Post-COVID-19.

1. INTRODUCTION

Globally, the impacts of COVID-19 are still being felt in other sectors of the economy, despite the effective management of its global spread. Regrettably, the COVID-19 pandemic has been adjudged to be the most significant public health challenge of the 21st century (Greenstone & Nigam 2020). In its early days, several studies examined its impacts on essential services such as waste management, health, economy, environment, tourism, and transportation (Kulkani & Anatharama, 2020; Nghiem et al. 2020; Nzediegwu & Chang, 2020; Oyedotun et al., 2020; Moonsammy et al., 2021; Beck & Hensher, 2020; Capital Area Transit Systems, CATS, 2020; CBS, 2020; Wuyts et al., 2020; Committee for the Coordination Statistical Activities, CCSA, 2020).

The enforced mobility restrictions adopted during the pandemic led to the development and utilization of mobility tracking Apps such as Google COVID-19 Community Mobility Reports, Apple Mobility Trends, and Public Transit Index as data-gathering tools and for assessing mobility patterns. For instance, Google provided city scale mobility data (Google COVID-19 mobility 2020), while similar approaches were adopted in studies carried out in Switzerland, Sweden, Britain, and Chile (Molloy et al., WSP, 2020; Department of Transport, 2020; Tirachini, et al., 2020a; Tirachini, et al., 2020b). The main finding from these studies revealed a decline in public transportation, mainly due to mobility restrictions and commuters' risk perceptions.



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Furthermore, studies by Museelwhite et al., (2020) and a report by the Public Health Agency (PHA, 2020) revealed that bus stops and public transport are susceptible for the spread of COVID-19. This is chiefly because of their limited space, availability of large surface areas and challenges with testing commuters and transport operators. Expectedly, these revelations portend danger for sustainable mobility. Studies in England, Scotland, and Wales all revealed a drastic fall for all modes of public transport during the onset of the pandemic and afterward (Department of Transport, 2020). Similarly, the rail system also suffered from the pandemic. For example, in the UK, all franchises changed from privately or publicly owned to management contracts through an Emergency Measures agreement. This led to a continuous fall in rail service and an estimated loss of about £5 billion (Department of Transport, Department of Transport, 2020b; UK Parliament's Public Accounts Committee 2020). According to the Department of Transport (2020), projections, six years of operations are needed before normalcy can be restored in the UK rail sector.

Surprisingly, studies conducted in Australia during the initial phase of the pandemic found that trips by private transport were more adversely affected than public transport (Beck & Hensher, 2020). For instance, trips by personal vehicles were reduced significantly by 47%, while public transport was reduced by 8% (Beck & Hensher, 2020). The decline in private transport might be due to the adoption of work-from-home strategies. In England, during the first phase of the pandemic, there was an upsurge in non-conventional modes such as walking and cycling, both for daily and weekend trips. According to Vickerman (2021), the aviation and maritime sectors were most affected by the pandemic. For example, many flights were canceled, this was largely because of substantial border restrictions (Vickerman, 2021). According to The International Air Transport Association (IATA) an estimated \$84 billion was lost by the aviation sector in 2020 due to the pandemic.

However, these studies were limited on many fronts. First, these studies were either too broad in their scope or relatively too small, using city-scale data made available through data acquired from mobile Apps. Similarly, more recent studies primarily focus on challenges with daily commuting and methods of public transport deliveries (Kamga & Eickemeyer; 2021; Vickerman, 2021). More precisely, most of these studies do not compare commuters' perception of risks of public transportation during or after a public health challenge such as the pandemic but largely focus on mobility trends.

This study uses the Protection Motivation Theory as a theoretical framework. The Protection Motivation theory (Rogers, 1975) emphasized the significance of risk perception in modifying behavior and decisions in cases of uncertainty. Consequently, commuters' perception of a public health challenge such as COVID-19 can influence their transport mode choice and travel demand even after the pandemic has subsided. More precisely, risk perceptions have been found to influence individual and organizational decisions (Sjoberg et al., 2004). It can be assumed that commuters will avoid transport modes with a high probability of contagion of the spread of a virus while adopting transport modes with less probability for spread.

A study by Tan and Ma, (2021) considered commuters' behavior during the COVID-19 pandemic. The study revealed that public and private transportation systems, the nature of the job and walking time from residence to the subway station are factors that increase the risks of infection through the rail system. Consequently, commuters with high-risk perceptions of contracting the virus through public transport were found to stop commuting by rail. However, Tan and Ma (2021) study focused on the rail system, while other modes of public transport such



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as bus, shuttle, and taxis were not considered. Another study by Basu and Ferreira (2021) examined the challenges and opportunities of Metro-line in post-COVID-19 in Boston. The study revealed that there was an increase in car ownership pre-COVID and Post-COVID-19 and a decrease in public transportation because of the risk perception of commuters. Thus implying an erosion of commuters' trust in public transportation.

Further, Scorrano and Danielis (2021) using an integrated model investigated the mode of transport use before and during the Covid-19 pandemic in an Italian city. Their study reveals an increase in active transportation such as cycling and walking, though insignificant. Also, there is a high substitution between motorcycles and buses. Thus, the pandemic have a negative impact on public transportation and a positive impact on private transport.

Despite, the growing literature on the impacts of the pandemic on public transportation during and Post-COVID. Yet, till date, relatively few studies have compared commuters' risk perceptions and rationality towards public transportation during and after the onset of a public health emergency. Expectedly, the shift in modal choice of commuters for public transportation is a reflection of their risk judgment of being infected. Continuous adoption of private transport will negatively affect sustainable mobility and mass transit initiatives. Therefore, this study sought to explore commuters' risk perceptions and behaviors during and Post COVID-19 in an unorganized public transport system like Nigeria. This will help transport policy experts in Africa and elsewhere to develop measures for promoting sustainable mobility and restoring public confidence in public transport during and after a public health emergency.

2. MATERIALS and METHODS

2.1 Study Area

The study was conducted in Nigeria. Geographically, the country lies between longitude 3⁰ and 14⁰ E and Latitude 4⁰ and 15⁰N. Relatively, it is bounded in the east by the Republic of Cameroon, in the west, by the Republic of Benin and north by the Republics of Chad and Niger, and in the south by the Gulf of Guinea. Nigeria has a coastline of about 420 nautical miles with a network intersecting over 3000 connected rivers and creeks. Inland areas, the country has 900,890 km² and 13,879km². The climatic condition of the country is equatorial, with high temperatures and high rainfall. Administratively, the country is divided into 36 administrative states and with a Federal Capital at Abuja.

Nigeria has a total road network of 204,000km, the largest road network in West Africa and the second largest in the south of the Sahara. The road network consists of 35,000km of federal roads, 39,423km of state roads, and 129,577km² of local government roads. These roads were classified as Trunk A for federal roads, Trunk B for state roads, and Trunk C for local roads; the federal roads accounted for over eighty percent of national vehicular traffic and cut across states and zones in the country (FRSC, 2007).

2.2 Methods

2.2.1 Research design

The study adopted a mixed research design, whereby both qualitative and quantitative data are collected. Qualitative data were gathered through in-depth telephone interviews with twelve respondents across the six geopolitical zones, while quantitative data was collected through an online and offline survey. A semi-structured questionnaire was designed to generate self-



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reported statements by commuters on their commuting behavior and risk perception to public transportation during and Post-COVID-19. The questionnaire was designed based on the Risk Protection Theory by Rogers (1975) and was revised by transport experts and medical geographers at the University of Ibadan.

The final version of the questionnaire consisted of four sections which included close-ended, semi-open-ended questions, and open-ended questions. The first section contains nine questions, which capture the socio-economic characteristics of commuters. The second section also consists of nine questions, which was adapted from (Roche-Cerasi, et al., 2013) and sought to capture commuters' mode preferences during and Post-COVID-19. In the third section, a total of six questions were used to collect commuters' responses to public health measures enacted to curtail the spread of the COVID-19 after lockdowns. These questions were related to similar instruments developed by in addressing transport risks judgment for road transport (Rundmo, et al., 2011).

2.2.3 Data collection

The online data collection form was created through a Google data collection form. The questionnaire was administered after the relaxation of mobility restrictions and in the early days of the discovery of vaccines. Focal persons were engaged in each region to help populate the research through various links such as WhatsApp, Facebook, emails, and professional contacts. The geographical spread of respondents is shown in Table 1. Critical factors such as adherence to social distancing policies, and challenges with essential services such as electricity, and internet coverage affect the geographical spread of the survey as it was tilted towards certain zones where these services are available.

Table 1. Respondents across the six geopolitical zones in Nigeria

Zones	Respondent	Percent
South-west	244	78.2
South-east	16	5.1
South-south	12	3.9
North-west	4	1.3
North-east	4	1.3
North-central	32	10.2
N	312	100.0

2.2.4 Data analysis

Quantitative data was assessed using descriptive statistics while qualitative data was content analyzed. The questionnaire was completed by 312 respondents. The data collected from the Google form and the hard copies printed were merged and transferred into a spreadsheet. The spreadsheet was downloaded, modified and transferred into the SPSS spreadsheet environment for analysis.

The last section was assessed by developing a Commuters' Risk Perception Index (CRPI). The use of indexes to measure residents' perception of urban services has been affirmed in many studies. Such studies include Afon (Afon, 2006), Center for Public Policy and Social Research (CPPSR 2005), and Opricovic & Tzeng, 2003. This method has been averred to be an extension



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of the multi-criteria model, where different features of a service rating are generated, weight is assigned to each generated rating, and an index for each is arrived at to produce a rank for each rating that reveals the level of perception (Opricovic & Tzeng, 2003). Thus, adopted in this study. The Commuters Risk Perception dimension was measured using five items, with respondents required to indicate the extent to which each of the items described their risk perception on a five-point Likert scale with ratings from 1 “*strongly disagreed*” and 5 “*strongly agreed*”. The Summated Weight Value SWV for each attribute is obtained by summing the product of the number of responses for each rating to an attribute and its respective weight value.

Express mathematically:

$$SWV = \sum_{i=1}^5 NiVi$$

Where SWV=Summated Weight Value

Ni= number of respondents rating an attribute i

Vi= weight assigned to attribute i

The CRPI for each risk perceived was obtained by dividing the SWV by the summation of the respondents to each of the five ratings. Expressed mathematically as

$$CRPI = SWV / \sum_{i=1}^5 NiVi$$

Where CRPC= Commuters Risks Perception Index

3. RESULTS

3.1 Socio-economic characteristics of sampled respondents

Table 2 presents the socio-economic characteristics of sampled participants. The study revealed that about two-thirds of respondents were male (60.3%). Further, regarding the type of commuters, investigations revealed that more than two-fifths of respondents were employed, and about one-third were self-employed and unemployed respectively. On respondents' level of education, the study found that about 97.4% of respondents had tertiary education. Conducting the survey online might have been responsible for the large responses of educated commuters. It might also imply that the majority of respondents live in urban areas. Assessment of vehicle ownership revealed that a majority of respondents do not own a vehicle. This evidence affirms the need for sustainable public mobility post-COVID which could be negatively impacted by commuters' loss of confidence in public transport due to perception of contagion of a disease/virus.



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Table 2. Socio-economic characteristics of sampled respondents

Socio-economic characteristics	Distribution	Respondent	Percent
Sex	Female	124	39.7
	Male	188	60.3
	N	312	100.0
Type of commuter	Employed	132	42.3
	Self-employed	92	29.5
	Unemployed	88	28.2
	N	312	100.0
Level of education	Primary	-	-
	Secondary	8	2.6
	Tertiary	304	97.4
	N	312	100.0
Age	18-27	132	42.3
	28-37	87	27.9
	38-47	20	6.4
	Above 47	73	23.4
	N	312	100.0
Vehicle ownership	Own a vehicle	28	9.0
	Do not own a	284	91.0
	N	312	100.0

3.2 Trip Pattern Behavior and the Main Impact of COVID-19 on

Table 3 shows the result of trip pattern behavior of respondents during the pandemic and post-COVID-19 era. Trips purpose for work remained relatively unchanged during and after Post-COVID-19. More so, during the pandemic public workers from level thirteen upwards were mandated to continue to commute to work. Hence, always in transit. This result was inconsistent with findings in Australia, which also enforces social distancing measures. There was a fall in trip purposes for work during the pandemic, as workers were encouraged to work from home (Beck & Hensher 2020). In Sweden, social distancing measures were not mandatory but recommended. A study in Sweden revealed a reduction in trips for all purposes during and post-COVID-19 (Jenelius et al., 2020).

For trip purposes for leisure/shopping, there was a sharp increase of 13.4%, on the contrary, trip purposes for health fell sharply by 10.0% between these periods. Similarly, other trip purposes also decreased by 3.5% during these two periods.

In-depth interview discussants reported that the mobility restrictions are largely effective due to the presence of the military and the fear of the virus.

According to a key informant interviewee,



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“Everyone was afraid when the pandemic first incident case was announced on February 27th, 2020 by the National Center for Disease Control. However, with time and the low numbers of cases recorded, the people began to restore their confidence in public transport. More so, the Federal government is only imitating the procedures adopted by the West without considering the impact of mobility restrictions on an informal economy like ours”

Another respondent commented:

“Well, our government is only saying their own, we still move, just that we have to pay exorbitant fees as drivers have to bribe many of the security officials on the road.” The other nations that enacted hard lockdowns also provide access to food for their citizens, and there are ways food supplies reach every citizen. Our case is different; we have to go out to look for our daily food except you work for the government”

During the pandemic, the study shows that more than half of respondents took single daily trips while about one-third (24.5%) of respondents took two trips per day. However, post-COVID, slightly more than one-third of respondents took two daily trips, about one-fifth of respondents took single trips, and about one-fifth of respondents took three daily trips. Expectedly, there was a significant reduction in daily commuting post-COVID-19. This might be due to the prevailing economic situation and commuters’ risks perception post-COVID. During the pandemic, the dominant choice of transport was bus/shuttle and Taxi. Although, their share was relatively small. Post-COVID-19, about one-third of respondents adopted a substitutionary approach. They substitute different modes of transport as measures in managing the risks of contagion, while motorcycles there was a significant increase in mode choice for motorcycles and Taxi. Although, the increase is still relatively insignificant. This evidence suggests that commuters change from mass transit mode to non-conventional transport modes such as motorcycles in response to the risk of contracting the virus through public transportation.

Furthermore, the cost of transport during and post-COVID-19 was assessed. Broadly, the result revealed relatively insignificant changes in transportation costs during and after the pandemic. About two-fifths of respondents still spend between one hundred and three hundred naira. However, there was a significant change in trip cost between 301-500 naira, as there was 9.0% increase in price (Table 3).

Table 3. Trip pattern behavior

Trip Pattern Behavior	Trip Purpose COVID-19		Trip purpose Post-COVID-19	
	Res	%	Res	%
Main Trip Purpose				
Work	196	62.8	196	62.8
Leisure/Shopping	54	17.4	96	30.8
Health	36	11.5	5	1.6
Other	26	8.3	15	4.8
N	312	100.0	312	100.0
Average daily trips	Number of trips during COVID		Number of trips Post-COVID-19 Era	
	Res	%	Res	%
None	20	6.4	12	3.8
1	164	52.6	68	21.8
2	76	24.4	96	30.8



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3	16	5.1	60	19.2
4	16	5.1	44	14.1
5	16	5.1	24	7.7
Uncertain	4	1.3	8	2.6
N	312		312	
Modal choice of transport	During COVID		Post-COVID-19 Era	
Motorcycle	40	12.8	68	21.8
Tricycle	36	11.5	24	7.7
Walking	24	7.7	32	10.3
Bus/shuttle	124	39.8	36	11.5
Taxis	80	25.6	64	20.5
Combined measures	-	-	88	28.2
Others	8	2.6	-	
N	312	100.0	312	100.0
Average Cost of transport	During COVID		Post-COVID-19 Era	
100-300	148	47.4	148	47.4
301-500	12	3.8	40	12.8
501-700	44	14.1	20	6.4
701-900	24	7.7	8	2.7
901-1,100	24	7.7	24	7.7
1101-1300	8	2.6	12	3.8
1301-1500	16	5.1	12	3.8
Above 1501	36	11.6	48	15.4
N	312	100.0	312	200.0

3.2.2 Main Impact of the Pandemic On Commuters

Table 4 shows the significant impact of the pandemic on commuting during the pandemic era. The study revealed that two-thirds of respondents experienced aggregated impacts, while about one-third of respondents' major impacts were related to an increase in transportation costs. Other negative impacts reported include increased delay time and reduction in social interaction during trips.

Table 4. Major Impact on commuters during the pandemic

Main impact	Respondents	Percent
Increase in transportation cost	100	32.1
Increase in awareness of public health	4	1.3
Increase in delay time	8	2.6
Reduction in social interaction during trips	8	2.6
Aggregated impacts	192	61.4
N	312	100.0

3.3 Commuters' Response to Social Distancing Measures on Public Transportation

Table 5 presents the results of commuters' response to social distancing measures on public transportation. The study revealed that more than half (56.4%) of respondents wear their nose



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masks whenever they board public transport, about one-third (28.2%) respondents rarely wear nose masks, and 15.4% of respondents do not wear them. Further, on reasons why respondents do not always wear masks whenever they board public transport, about two-thirds (64.7%) of respondents reported that wearing a nose mask is stressful. Responses on whether respondents wash their hands with alcohol-based sanitizer or soaps were documented. More than half of the (53.9%) respondents wash their hands with alcohol-based sanitizer or soaps and running water before and after each trip, about one-third (25.6%) respondents reported that they do not wash their hands before each trip, while about 20.5% respondents do not always wash hands before and after each trip.

Concerning the reasons for not washing their hands, about 63.2% of respondents do not wash their hands because of the failure of operators to provide sanitizers and soaps, while 20.8% of respondents do not wash their hands due to the long queues. The survey sought to know if operators disinfect vehicles before commuters are allowed to come in. A majority (98.7%) of operators do not disinfect their vehicles. Furthermore, the study revealed that a majority (84.6%) of operators' decisions not to disinfect their vehicles do not affect commuters' decision to commute.

Table 5: Commuters response to social distancing measures on Public Transportation

Response	Measures	Respondent	Percent
Wear a nose mask			
	Maybe	88	28.2
	No	48	15.4
	Yes	176	56.4
	N	312	200.0
Reasons for not			
	Fear of suffocating	8	5.9
	Not necessarily	8	5.9
	Not always handy	8	5.9
	Not comfortable with it	8	5.9
	Other commuters'	16	11.7
	The stress of wearing a	88	64.7
	N	136	100.0
Wash hands with			
	Wash hands	168	53.9
	Do not wash hands	80	25.6
	Not always	64	20.5
	N	312	100.0
Reasons for not using			
	Time wasted in a queue	30	20.8
	Increase in cost of	23	16.0
	Operators failure to	91	63.2
	N	144	100.0
If operators disinfect			
	Disinfect	4	1.3



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Do not disinfect	308	98.7
N	312	100.0
Effects of operators not		
Affect	48	15.4
Do not affect	264	84.6
N	312	100.0

3.3.2 Operators Perception on social distance measures Post-COVID-19

Globally, the pandemic resulted into huge loss of revenue for many operators. Many of these operators were forced to implement social distancing measures such as reducing the load capacity of vehicles, providing alcohol-based sanitizer, water, and soaps for commuters, maintaining 1.5m feet apart between commuters, etc. On one hand, a majority of these operators reported that these measures help limit the spread of the virus. On the other hand, they also averred that these measures forced them to operate below their full capacity, which negatively impacted their performance and profitability. According to a discussant on the phone:

“Enforcement of social distancing measures to combat the pandemic in the transport sector is a good one. However, the government in developed countries gives emergency funds and grants to the transport sector to mitigate the reduction in revenue necessitated by the pandemic. On the Nigerian government's part, all the burden falls on the operators and indirectly on the commuters who have to pay for.”

On the sustainability of these measures, most operators affirmed that social distancing measures would die a natural death with vaccines being readily available. More so, operators will return to normal productivity levels. One of the operators confirmed this observation during a telephone conversation,

“The social distancing measures are gradually dying except for the use of nose masks, others such as carrying 60% of the load capacity, washing of hands with soaps/sanitizers and maintaining distance between commuters is gradually phasing out. For daily commuting, the cost of adoption of these measures is telling on the people and operators. Some operators now demand commuters come with their hand sanitizers or any other PPE needed for self-protection. At the same time, the majority operates as if the war against the pandemic has been conquered completely”.

3.4 Commuters’ Risk Perception in Post COVID-19 Era

In this section, a commuters’ risk perception index was developed to measure commuters’ risk perception post-COVID-19. The mean values of the risk index indicate the extent to which commuters’ perceived risk. The result shows that commuters often cover their nose with nose masks and use sanitizers to reduce the risk of contracting COVID-19 ($x=3.72$), reduction in the frequency of visits to public places ($x=3.51$) are measures highly practiced by commuters in responding to risk, while the likelihood of changing modal choice as a result of the pandemic ($x=2.88$), taking more walks or cycling($x=2.83$) and decrease in the frequency of trips($x=2.81$) are poorly practiced. Nigeria operates a highly informal economy where the livelihoods of residents depend on their daily commuting. Thus, the choice of commuters to keep commuting and adopting social distance measures such as using nose masks, reducing trips to public recreation places, then reducing trips for work or health. While commuting via cycling and



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walking is more beneficial, it was observed that it was rarely adopted. This is because these modes have not been integrated into the Nigerian transport system and are also part of the Nigerian commuting culture. Hence commuters do not respond positively to changes of modal choice and adoption of cycling and walking.

Table 6: Commuters Risks Perception Index (n=312)

Variables	Minimum	Maximum	Mean	Rank	(A-μ)	(A-μ) ²
Would you decrease the frequency of trips based on fears of exposure to the pandemic	1.00	5.00	2.81	5 th	-0.34	0.1156
Are you likely to change your modal choice as a result of the pandemic	1.00	5.00	2.88	3 rd	-0.27	0.0729
Do you take more walks or cycle to reduce exposure to the virus	1.00	5.00	2.83	4 th	-0.32	0.1024
Do you always cover your nose with nose masks and use sanitizers to reduce pandemic contact	1.00	5.00	3.72	1 st	0.57	0.3249
Did you reduce your frequency of visiting public recreation places (eateries, Cafes, movie theaters) even as lockdown measures were relaxed	1.00	5.00	3.51	2 nd	0.36	0.1296

4. DISCUSSION

In this study, the majority of respondents were employed and did not own a vehicle. Thus, many of these respondents will depend on public transportation systems. The study revealed no significant change in trip purposes for work during and after the mobility restrictions compared to other trip purposes. In Nigeria and elsewhere in Africa, public transportation systems are often characterized by resource imbalance, infrastructural deficit, variation in objectives by operators and policymakers, and weak intermodal linkages. Hence, the impacts of the social distancing measures such as mobility restrictions will exacerbate the chaotic transport network in the face of a public health emergency such as Post-COVID-19.

One main finding of this study is the change in modal choice from bus/shuttle to non-conventional modes such as motorcycles and Taxis. This might be due to the fear of contracting the virus through buses/shuttles. These fears are justifiable as studies by Museelwhite et al. (2020) and PHA (2020) confirmed that public transport modes such as buses and shuttles are more susceptible to spreading the virus. However, Famewo et al., (2020) suggested that active transportation modes such as motorcycles should only be limited to intra-city and campus transportation systems and not city transportation systems as they portend greater danger for commuters in the city.



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The findings suggested that Nigerian commuters will adopt social distancing measures that are compatible with maintaining daily commuting while they will reject measures that will enforce mobility restrictions during any public health emergency. Their choices are largely due to the high level of informality, the poor level of the public transport system, and the failure of the government and its agencies to mitigate the economic impact of public health emergencies. Consequently, it might be difficult to envision and realize sustainable mobility in a system that has a pervasive transport system as it is the case of Nigeria. More so, it will be difficult to gain public confidence during and after such public health emergencies in such climes.

Finally, the study developed a commuters' risk perception index to measure and rank commuters' risk to public transportation in Post COVID-19 era. The study revealed that commuters highly adopt the use of nose masks and sanitizers in responding to the pandemic, while commuters' reduction in the frequency of trips was poorly practiced.

5. CONCLUSION

This study documents commuters' behavior and risk perception towards the public transportation system during and post-COVID-era in Nigeria. Moreover, lack of planning, shortage of transport infrastructure, environmental impacts of transportation, traffic demand, accessibility, inter-modal linkages, and affordability still characterize public transport in Nigeria and elsewhere in Africa. A chaotic public transportation system will limit individual and organizational decisions toward promoting sustainable mobility during any public health emergencies. Expectedly, commuters' risk judgment will affect public transportation and modal choice in public health emergencies. Hence, there is a need for holistic measures in the quest for sustainable mobility and mass transit that can lead to public health emergencies.

We suggest the need to transition to sustainable mobility that would be based on an urban plan that considers investment in modern transport infrastructure, an integrated transport system that integrates different land uses, and transport modes, and has respect for the socio-cultural context of commuters.

6. STUDY LIMITATIONS

This study comes with several limitations. First, by adopting a cross-sectional study, the study suffers from the inherent limitations that come with such a survey-based research method. This can be addressed in the future through longitudinal studies. Also, the use of telephone interviews to capture qualitative data might limit the validation of the submission of the interviewees, as body language could not be captured. However, these methods give commuters and operators the flexibility to express themselves without much interference. Also, the initial use of an online survey which was later supported with printed hard copies might have limited responses from respondents who live in rural areas or areas without internet access. However, none of these limitations have a strong influence to affect reported responses.

Ethical Approval

The nature of the research was not done with animals, vulnerable groups, or in an invasive manner. The research was done in complete confidentiality with voluntary participants.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The nature of the work does not involve animals, vulnerable groups, or in an invasive manner. The research was done in full confidentiality with voluntary participants.

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THE EFFICACY OF INTERNET OF THINGS (IOT) BASED INTELLIGENCE ON SMART CITY SYSTEM ARCHITECTURE

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ABSTRACT

Cities around the world are becoming smarter with the use of innovative technologies. The applications of the Internet of Things (IoT) in some cities have immensely influenced communication, transportation and policy efficiency, promote sustainability, reduce waste and inconvenience and ultimately increased economic and social service quality in such cities. A smart city is predominantly composed of the use of advanced connectivity of devices, systems and services to develop and promote sustainable practices in order to improve operational efficiency and provide better quality of life. IoT is mostly used for the automation of appliances such as wearables and scannable devices including waste bins, vehicles, bridges, etc., and the control of lighting, heating and ventilation systems. Hollands (2008) defined a smart city as the one that allows the application of innovative technologies to its various components including governance, transport, housing, business, sustainable living, social learning, community engagement, etc., with the aim of creating better living experiences for the city's population. This paper is a document review on Internet of Things (IoT) based intelligence on smart city system architecture. The paper described various IOT based components of a smart city. Also discussed in the paper write-up are some of the challenges of Internet of Things (IoT) deployment for of a smart city. In order to gather relevant information for the paper discussion, online Google form questionnaire instrument was used to collect data from respondents. The responses collated were subjected to reliability analysis by experts. Conclusively, recommendations were made.

Keyword: Internet of Things, IOT Based Intelligence, Smart City, Architecture.

1. INTRODUCTION

Smart Cities are governmental initiatives for making cities more navigable and adaptable to the increasingly growing population of city dwellers to enhance better living experience in areas such as communication, transportation and policy efficiency so as to promote sustainability, reduce waste and inconvenience and ultimately increased economic and social service quality in profound ways. Internet of Things (IoT) which refers to the automation of appliances such as wearables and scannable devices including waste bins, vehicles, bridges, etc., and the control of lighting, heating and ventilation systems through internet connectivity has helped to make life better in the various sectors of cities including



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governance, transport, housing, business, sustainable living, social learning, community engagement and many more. This paper provides a document review of IoT based intelligence on smart city system architecture and discuss described various IOT based components of a smart city. Some of the challenges of Internet of Things (IoT) deployment in smart cities were also discussed in the paper.



2. RELATED LITERATURE

Hollands (2008) sees smart cities as the use of the evoking technologies to create a better living experience for city dwellers. According to Rojek & Studzinski (2019), Smart city services that involve municipal tasks including waste management, supply of water, monitoring and environmental control are targeted towards the sustenance of the city's population. Benjamin et al. (2015) posit that the possibility of connecting identifiable objects in smart cities is on the high side. Ejaz & Anpalagan (2019) explained the architecture and applications of IoT in Smart Cities and the various technologies used. Somayya (1991) discussed the numerous applications IoT in Smart Cities as becoming popular across many vertical and horizontal markets. Silva, et al (2018) explained the applications of some systems used in various sectors of smart cities. According to Dutta, et al. (2017) and Al-Turjman & Malekloo (2019), sensors are used in smart cities to monitor environmental conditions so as to determine the pollution level and also guide citizens to free parking space so as to save cost. Despite the benefits of using IoT in Smart cities, it is also confronted with a number of challenges (Rolf, 2010).

Components of IoT Based Smart Cities

1. Smart Home:

This is essentially a major component of Smart Cities since it directly related to the life of city's dwellers. This involves the use of sensors that provide information to monitor the users' activities within and around their homes.

2. Smart infrastructure:

Smart infrastructure such bridges, roads and buildings equipped with sensors are paramount for predictive maintenance of operations of the listed components of the city.

3. Smart City Services:

Smart city services such as water, waste and environmental control are



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equipped with sensors for adequate update to ensure proper management.

4. Smart Energy:

Smart Grids make use of ICT technologies to ensure regular updates on the distributed energy generation at both the consumer end and utility end and it also equipped with self-healing capabilities.

5. Smart Transportation:

The development and implementation of innovative technologies have made the design of smart transportation systems possible. GPS devices help to generate data which are used to track traffic patterns and driver behavior.

Challenges in IoT Based Smart Cities

Besides the benefits of digitization of every domain of a city's operation mechanism, the deployment of IoT systems carries several challenges that need to be considered. Viz:-

1. Security and Privacy:

The primary concern in smart cities is security and privacy issues. Because essential city infrastructures are online, the aberration of any of the operations will bring inconvenience to the city dwellers thereby putting lives and properties at risk.

2. Networking

IoT depends on the capability of sensors and the interconnectivity of all identifiable devices in order to send and receive information among themselves and the Cloud. Ensuring effective networks for these devices to remain connected is a big concern.

3. Smart Sensors:

Smart sensors are manufactured by host of numerous vendors with enormous sensing mechanisms, data formats, standards of measurement and connectivity protocols. The operation involved in the deployment required by Smart cities for all these devices to perform tasks scheduling between them, exchange data and aggregate these data together for making inferences are complicated.

4. Big Data Analytics

The growing rate of data generated by IoT connected devices are on a daily increase. In order to make use of this data and constantly improve on the services delivered in smart cities, there is a need to develop new data analytics algorithms. This poses a big challenge.

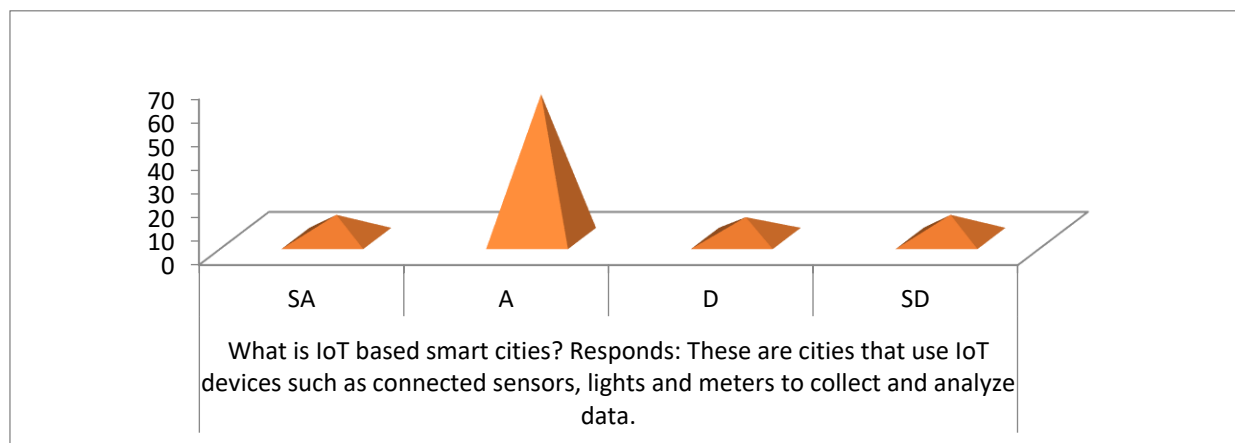
3. MATERIALS and METHODS

This paper discussion is focused on Internet of Things (IOT) based components of a smart city. The accessible populations for the study were states in randomly selected developed countries around the world. For the purpose of eliciting useful

information for the paper discussion, carefully structured copies of questionnaires were administered to respondents using online Google form questionnaire instrument. The gathered responses were subjected to Cronbach's alpha reliability analysis. The result of 0.87 gave a good reliability index of the instrument. The entire exercise took place within the duration of 41 days before completion.

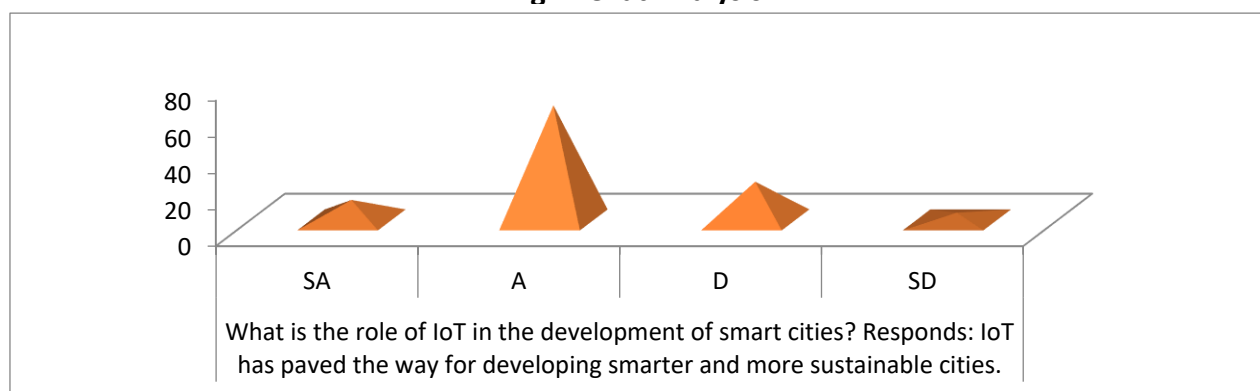
4. RESULTS and DISCUSSION

Fig.1: Chat Analysis



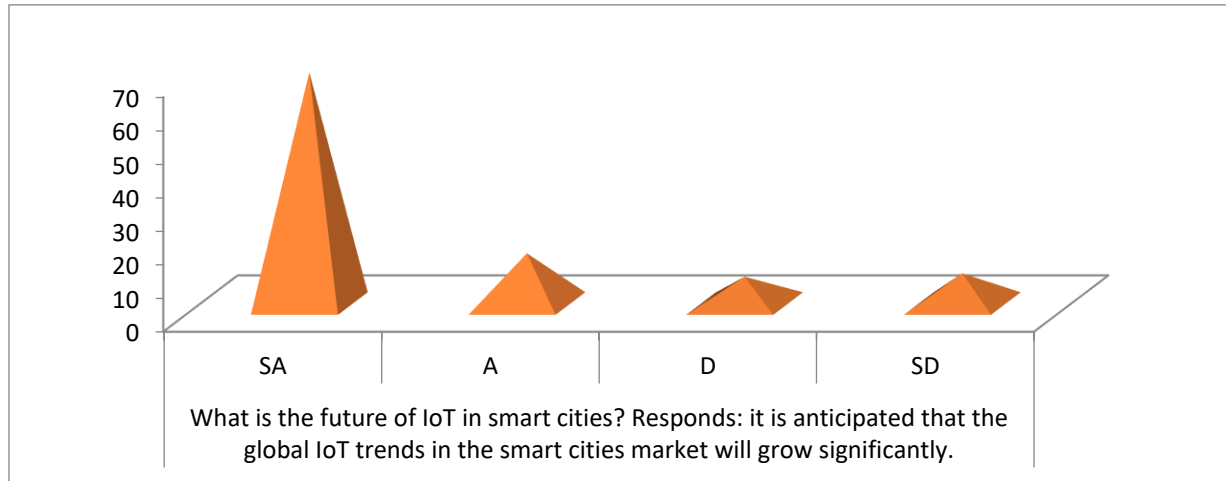
The graph plotted in Figure 1 indicates that most of the respondents are knowledgeable of smart city concepts. The respondents precisely noted that smart cities use IoT devices such as connected sensors, lights, and meters to collect and analyze data. The respondents further explain that smart cities resultantly use the data gathered by IoT-enabled devices from various parameters to improve public utilities, social infrastructure and services provided for the city dwellers.

Fig.2: Chat Analysis



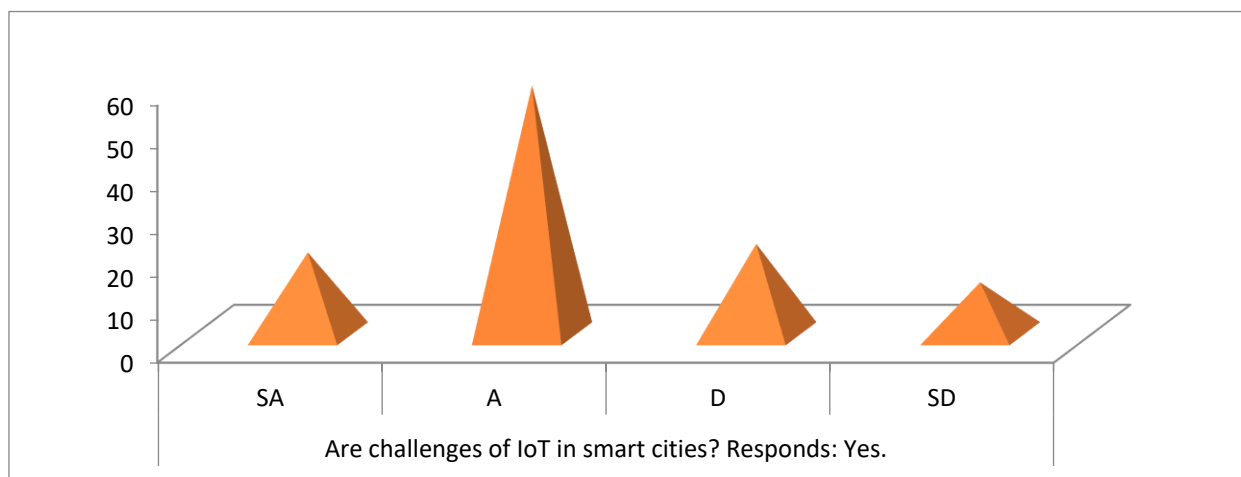
The chat analysis shown in Figure 2 depicts that the influence of Internet of Things (IoT) on the development of smart cities cannot be undermined. The respondents noted IoT has paved the way for developing smarter and more sustainable cities. According to the respondents, IoT technologies are increasingly revolutionizing the way people live and interact with each other in the city from enhancing public safety and citizen engagement to optimizing energy consumption and transportation.

Fig.3: Chat Analysis



The graph plotted in Figure 3 suggests that a very high number of the respondents agree with the statement that there are better days ahead of IoT influenced smart cities. According to the respondents, it is anticipated that the global IoT trends in the smart cities market will grow significantly. The respondents also noted that one of the key benefits of IoT in smart cities is improved traffic management. In addition, the respondents opine that the deployment of IoT technologies in cities could be useful in monitoring and managing traffic in real-time which will resultantly help to improve safety, reduce congestion and enhance overall transportation efficiency.

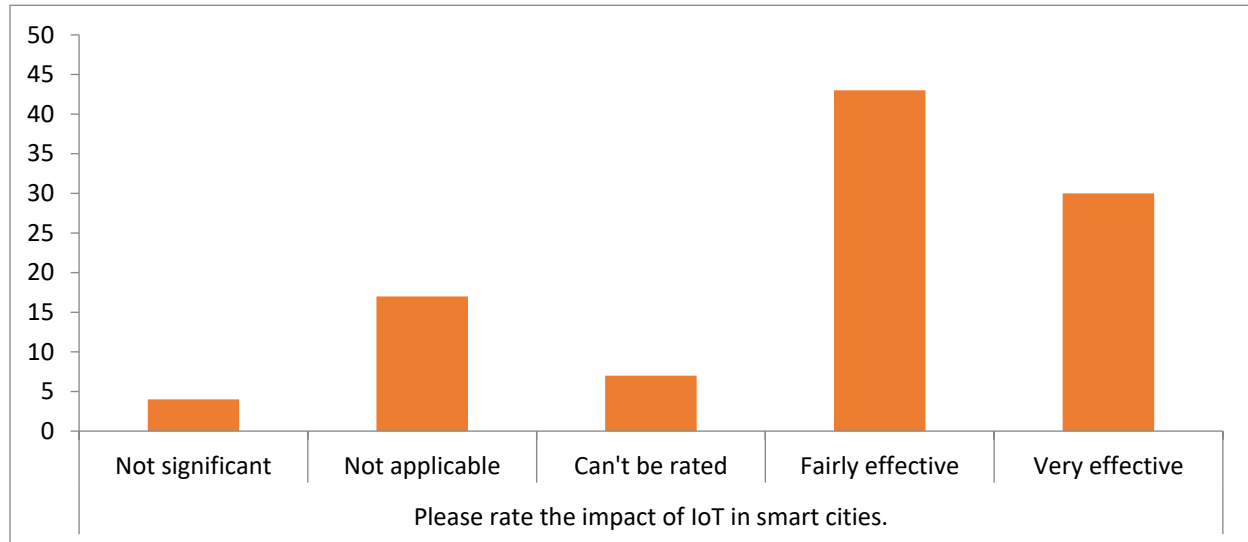
Fig.4: Chat Analysis



The graph plotted in Figure 4 indicate that a greater number of the respondents agree that that are obstacles or challenges confronting the implementation of Internet of thing (IoT) based intelligence on smart city architecture. According to the respondents, the key element of these challenges include: the problems with interoperability, security and privacy concerns and vulnerability to malicious activities by hackers because most of the objects connectivity are enabled through RFID.



Fig.5: Chat Analysis



The table plotted in Figure 5 shows that a significant number of the respondents rated the influence of Internet of Things (IoT) on smart cities architecture as being 'Effective'. The respondents explain that IoT has unlimited potential. According to the respondents, the deployment of IoT technologies into urban hubs could help to transform it into sustainable, efficient and smart cities.

5. CONCLUSION

This paper write-up is a contextual review on IOT based components of smart cities. Various IOT based components of smart cities were described in the paper work. Also contained in the paper discussion are some of the challenges confronted by the deployment of Internet of Things (IoT) based smart city architecture. The paper noted that Smart Cities are initiatives aimed at making city dwellers to experience better standards of living experience and to enjoy the innumerable social service offered by its government.

6. RECOMMENDATION

The concept of Internet of Things (IoT) based intelligence on smart city architecture is essentially critically important. Based on the current research on this paper, it was noted that most of the data transfer standards developed for IoT are not compatible as of the time this paper research work, it is therefore recommended that further research work should be carried out in this area to ensure effective communication among sensor nodes while utilizing low power using different protocols; this is imperative to improve on the intercommunication between IoT devices and invariably make the components of a smart city architecture smarter.

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INITIATIVE OF SMART & ECOLOGICAL CITY AROUND THE WORLD AS A PROCESS OF GLOBAL CHANGE

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ABSTRACT

The necessity of sustainable urban cities was observed throughout a survey in 2008 when the survey saw that more than half of humanity was living in urban areas in the world. An estimated 1900 urban areas account for 13% of the global population. The U.N. has estimated that by 2030, total urban areas will host 60% of the worldwide population. It is a significant concept of global change along with rapid changes in Africa and some parts of Asia. Urban areas are home to more than 470 million people in Africa, which accounts for an estimated 40 % of the total African population from an estimated 14 % of the population in the middle of the 20th century. In 2016, an estimated 512 cities hosted at least 1 million inhabitants, of which more than 100 cities were in China. By 2030, it has set up an estimated 660 cities, with around 40 cities categorized as megacities home to more than 10 million inhabitants, including Bogota, Bangkok, and Ho Chi Minh City. Cities have faced many challenges, including housing, sanitation, transportation, energy problems, etc. Also, issues have arisen in those developing and emerging countries due to weak institutions, poor resolution or no resolution processes, effects of climate change, waves of migration problems, etc. Therefore, a necessity has been created to explore sustainable, dynamic, healthy, and safe cities, which will be recognized as intelligent and ecological cities as a global change process. As a process of making smart cities building innovation through using tools like building information modelling (BIM), which is like 3D-modelling software with layers of data on every detail along with project timeline; evolution of internet system for overall information; linking houses, public buildings, factories vehicles, power sanitation, traffic signals, and street lighting etc. that makes a city 'smart.' Economic concern through promoting economic efficiency for creating more jobs and social inclusion are those things that can build a town dynamic and sustainable. The paper aims to discuss intelligent cities of the world as a concept of global changes through various sustainable facilities, including creating a green environment in ecology. The methodology has been conducted through documentary analysis. The feature question is, what are those challenges for building smart cities in developing countries, and why are smart cities required as a process of the sustainable world?

Keywords: Smart City, Eco-friendly, Ecological City, Global Change, Environmental Balanced, Technology, Infrastructure, Global Cities, Urbanization,

1. INTRODUCTION

A smart city has been defined by its urban planning, governance, transportation, technologies, environment, and health care system (World Economic Forum, 2021). The smart city always has many combinations of technologies, such as mobile solution, big data, artificial intelligence, blockchain, etc., through which they operate many concerns and addresses issues, such as data privacy and social exclusion. Smart city has been categorized by many globalized



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organizations, such as the World Bank's global smart city' partnership program, which has been defined through a virtual knowledge exchange program on smart cities for sustainable development (World Economic Forum, 2021). Many participants joined in this context to determine the smart city. Many terms emerged from the discussions, such as technology, innovation, connection, etc. The most valuable term was connection.' Participants finalized that smart cities can be made through community connections through awareness and collaboration. Realization and understanding to become clean in the city is another way they mentioned to maintain a smart city. Therefore, a clear definition can be made throughout the discussion that a smart city combines sustainability and resilience through which the city can be looked at urbanely. One of the examples has been given by the Chief Technology Officer of the City of Barcelona; as one of the global smart cities, the term' data and technology' over a smart city has been changed, and the term' citizens intelligence.' A common perspective about data and technology has been slightly altered to define smart cities, and many terms are included on the other side, such as the term humanizing technology. (World Economic Forum, 2021). It is a concept through which citizen of the cities have been involved to directly help the city management by suggesting ideas about smart city definitions and their implementation. Therefore, the City of Barcelona, as a model example, has already implemented a connection between its citizens, who are experienced in many disciplines, with city management to make better decisions, according to the Chief Technology Officer of Barcelona (World Economic Forum, 2021).

The role of the private sector in smart cities has been changed from selling widgets to promoting an outcome-driven model. A model like a stronger partnership has been accepted widely for helping urban leaders achieve their goals. Many private sector, civil society and academia come together to build a cooperative industry to develop the cities for proper living. Many models can be exemplified for good urbanization, such as Smart City Challenges by Infrastructured Canada, City Possible by Master Card, the Helsinki Energy Challenge, etc. (World Economic Forum, 2021). According to the Professor of the University of Pittsburgh, Mertin Weiss, the impact of COVID-19 has changed the views of policymakers globally, and newly intelligent city development has been categorized in every country for a sustainable environment through which citizens can live a healthy and better life by protecting them from such future virus. According to the professor and adviser, a system should be categorized as high-speed services instead of heavy infrastructure investment. The impact of COVID-19 has changed the views on mobility in cities. The Coordinator of the Chilean Transportation System, Pedro Vidal, said they had explored various ideas and implemented them in Chilean cities for mobilization through the connection with universities for advice. One of their innovations is creating more awareness to ride bicycles for city mobilization. Therefore, they made lanes on the road for bikes. This is how more sustainable cities have been categorized in Chile (World Economic Forum, 2021). According to the Deputy Director at the Open Government Partnership (OGP) Rudi Borrman, openness and transparency are essential for gathering data for public services. It was an effective route throughout open collaboration during the pandemic. According to her, a smart city can be defined when local governments create and innovate ways to coordinate and collaborate transparency with stakeholders. She says that this openness must be made on trust to bring solutions for the citizens by using technology. Therefore, the intelligent city definition depends on using technologies through an open engagement with citizens and local urban governance for better deeds. In the post-pandemic era, focus needs to be prioritized on equalities through which poor cities in poor developing countries can make their sustainable



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infrastructure for the better living of their citizens. Digital rights for every citizen, as well as data privacy, must be protected to build an intelligent urban community by technology and creating a protective environment (World Economic Forum, 2021).

2. LITERATURE REVIEW

Every developed or developing country dreams of making smart cities. But it is not that easy to make a smart city as it has many definitions that have been given above. A smart city is environmentally spread surrounding, green, clean, and sanitized, such as Edmonton, Alberta, Canada. Unfortunately, many developing countries' infrastructure is chaotic due to environmental, economic, and social disorders. Therefore, climatic problems arise and pollute urbanized areas through hot temperatures, acid rain, unmanageable humidity, etc. Indeed, a person from a cold country such as Canada can not afford the chaotic environmental features in those developing countries. Therefore, they cannot live sustainably for a long time and return to Canada with many health problems such as headaches, stomach problems through indigestion, etc. These are all due to the issues of the environmental, social, and economic features of the smart city characteristics of those developing countries. In this context, a general overview has been focused on practical experience by travelling to developing countries from Canada. Therefore, cities of developing countries must be environmentally friendly for a sustainable environment where citizens and travellers from any climatic characterized countries can live nicely and gently. In this context, plantation in cities for greenness is an important task to reform those cities for the recognition of smart cities. Urbanization must be built based on city law, and the law must be made on city structure where houses are made with enough space for sustainable activity such as plantation in yards of every home, making more parks for a more relaxed environment. Rain thus creates the influence of a green climate during the summer when it is uncontrollable. It is, therefore, a climatic chain which can be made by becoming eco-friendly in urban areas globally. In terms of technologies, smart cities must have a foundation of information technology (Beevor, 2018). Information technology can be invented by launching a speed internet system in urbanized areas and making more tools and machines by creating artificial intelligence. A balance is needed to develop smart cities, which can be possible by collaborating or combining public organizations, state and local governments and private enterprises. This is how a smart city can be created with facilities for business sustainability, disaster prevention, public safety, and life improvements. The smart city ecosystem and its I.T. infrastructure (Beevor, 2018) must be agile and flexible for all. Innovative city data processing must be effective, efficient, and analytical in real time. Otherwise, things are irrelevant for the making of smart cities. Recently, many citizens died (an estimated 4,000) in Libya through floods and other natural calamities. Their dead bodies were falling on the roadsides in the entire city because of the poor infrastructure of the Libyan cities, such as the absence of disaster management, warning satellites, lack of dams and bridges to tackle water from the rivers and seas and poor city sanitation to tackle floods from many sources (Ahramonline, 2023). The world's Smart cities must focus on that infrastructure system to protect their citizens from natural calamities. There is a governmental problem with making smart cities due to political differences and their views. It is a political challenge. The challenge can create the issue of funding due to ideological differences in making smart cities. There is another backdrop of challenge in making smart cities, which is private and public thinking differences and a lack of coordination. They must be cross collaborated for needing to know



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data sharing policy, standard network tools and other infrastructure. Therefore, an environment must be built for building digital infrastructure to support intelligence-led policing.

3. METHODOLOGY

The paper has been assumed through subordinate sources of data. Subordinate sources of data include academic articles, websites, etc. The description of sources has taken the method of writing the essay, reading, gathering in-depth insights on topics, exploring ideas, summarizing, interpreting, and mainly expressing in words (documentary analysis through qualitative approach). This paper has discussed many criteria of innovative city development through building social bonds and collaboration between authorities, building infrastructure by mentioning renowned professionals' recommendations and countries' disasters like Libya. This paper has given importance to ecology towards building smart cities, its digitalization and information technology systems for a better amalgamation between citizens and governance. It has discussed challenges and sincerely addressed the definition and structure of smart cities, a discussion of global cities, and an evaluation.

4. DISCUSSION

According to Navigant Research competent city evaluation has been made based on smart energy, smart water, smart transportation, smart buildings, smart government sectors and regional segmentation (Paul, 2017). City leaders and the federal government are now realizing the benefits of smart city development. Therefore, collaborations have been made with private industries and other stakeholders for economic benefits, sustainability, and quality of life. According to the Navigant research (Paul, 2017), an estimated 250 smart city projects from 178 countries worldwide have been initiated by the collaboration of governments and private organizations to fulfill energy, transportation, buildings, government solidarity and water goals. According to the research analyst of Navigant Research, Christina Jung, Leading cities are looking at how they can build on their initial investment in open data and the data feeds being provided by Internet of Things applications. Nowadays, due to the improvement of sensor technology, technologies of smart cities have been more developed and efficient for higher performance than before, according to the research group's report. Therefore, it is an expectation from the information that smart city solutions will grow from an estimated \$40.1 billion in 2017 to an estimated 97.9 billion in 2026 (Paul, 2017). Building smart cities has been prioritized because of the rapid increase in global population and their existence in cities. It has been reported that global cities now account for more than half of the worldwide population, which is an estimated 68%, according to the United Nations (Kosowatz, 2020). Therefore, a question has been raised: How will the management protect and maintain the city population due to the rapid increase of urbanization worldwide? It has been said that technology is once again a key which has always been a significant narrative during the discussion of smart city development for urbanization. Action has been initiated by leveraging technologies for the evolving smart city development program. For the demand of urban residents' policy, policymakers from the local and federal governments and urban planners have laid the foundation for leveraging technologies (Kosowatz, 2020). It has been initiated for better distribution of services among the residential communities in the urban areas. Those projects are in the infancy stage as most of the projects are in the background of a 'smart foundation.' After about ten years, a digital solution' has been created for the deliberation of real-time information to the users and providers through connected applications. Therefore, a definition of a smart city has been completed, which has been analyzed before that a smart



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city will be a combination of technical and mechanical solutions, which are intelligence IOT solutions for optimizing infrastructure and governance for better involvement with urban citizens in the management of services. Mobility, healthcare, security, water, energy community engagement, housing, economic development, and waste management are critical factors in creating a smart city and its innovation. There is a three-layer concept for the operation of a smart city. The first layer is technology, which is smartphones and sensors connected by high-speed communication networks, according to a scholar, McKinsey. According to McKinsey, the second layer is a specific application that translates the stream of raw data into alerts, insight, and action, and the third layer is getting buy-in and involvement with the public and participation from the crowd. Real-time crime mapping helps in policing, a connection between practitioners and patients through telemedicine that allows practitioners to arrive at patients' homes, digital tracking of waste receptacles which can predict garbage hauler when a can is full, online connection platforms for fast-speed internet access etc. are all narratives for innovative city-building initiatives. Many cities are providing those technologies for a digital and sustained urban livelihood.

The southeast Asian city-state of Singapore is the second most densely populated city in the world, with an estimated 8000 people per square kilometre. Facing such population growth and an aging population (Kosowatz, 2020), the government has prioritized a digital revolution to increase productivity in an advanced country. Therefore, the 'Smart Nation Vision' (Kosowatz, 2020) of Singapore aims to digitally collect information around the city by linking sensors to aggregation boxes. An estimated 95% of city homes have broadband access, and open sourcing brings the information to citizens and the private sectors to leverage the data for personal and business uses. The National Research Foundation has aimed to build Singapore as a digitized city on a 3D city model and collaborative data platform. By 2022, the government of Singapore has sought to implement intelligent and energy-efficient lighting for all public roads and solar panels installed on the rooftops of an estimated 6,000 buildings in Singapore City.

The Government of Emirates has decided to install all governmental services in Dubai City through a hyperloop (Kosowatz, 2020). Those services are transportation of Dubai, communications, electricity, infrastructure, economic assistance, and urban planning. An estimated 90% of services are now digitalized and accessible through the 'Dubai Now' app. Dubai is using high-tech projects by using innovative technology to build a 31-foot-tall 6889-square-foot concrete building. Dubai-Abu-Dhabi hyperloop is perhaps the best-known project; an estimated 151-kilometre-long and 10-kilometre section has been completed. Oslo, Norway, has been featured as a global smart city. The city has always focused on climate change issues, placing it one of the best-known livable urbanized cities in the world. Oslo comprises a wide use of sensors for controlling the city's lighting, heating, and cooling (Kosowatz, 2020). The city has set a goal to cut emissions by an estimated 36% by 2020 and an estimated 95% by 2030 for more technological development, electric vehicles, charging technology, and a smart grid. There are an estimated 2,000 charging vehicle stations. The owners of the cars do not need to pay taxes, and they are entitled to free parking, charging and transport on ferries.

Norway has already announced building a smart city near Oslo airport to create a new technologically driven community. Copenhagen, the capital of Denmark, is known for aggressive environmental policies to sustain the city's eco-friendliness. In 2017, the incubator Copenhagen Solution Lab was awarded for monitoring traffic, air quality, waste management and energy use for real-time operation. It connects traffic systems, parks, buildings, smart



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metering, and charging systems for electric vehicles to direct the traffic in the real-time process. Half of the Copenhagen residents, including their Prime Minister, bike to work (Financial express, 2018). The city of Boston, in the United States, was one of the first global cities to initiate a smart urban city concept. Its 'participatory urbanism' (Kosowatz, 2020) is one of the best smart city initiatives in the world for citizens' participation for advice and suggestions throughout their lifelong experience in many professional fields. Participatory Chinatown is a videogame for the involvement of communities in the planning and development of Boston. Traffic roars of Boston are famous for various mobilities. A micro hub, therefore, is created to control real-time information, buses, trains, bike-shares, car-shares, and other city services. Amsterdam, the Netherlands, has created an estimated 12,000 datasets and technology in every urban district (Kosowatz, 2020). Public and private collaboration has helped to build a smart grid in housing development, where power is distributed and stored on demand. The city has also generated electricity from carbon dioxide. Pedestrians and cyclists can use apps to increase their lights when passing by. New York City, the United States, placed hundreds of smart sensors and low-powered area networks throughout several districts. It will monitor and manage trash pickup waste containers fitted with sensors and monitor when the cans are full. New York police have tested web-based software from Hunch Lab to use historical crime data and other information to predict and respond to crime (Kosowatz, 2020). It helped to decrease crime in the city and helped to increase interest rates among other city agencies. Connected London through 5G connectivity for the entire city is one of London's major smart city programs.

The Mayor of London has started a platform for the development of urban areas and thus solves many issues. The city makes public data as much as possible for the citizens and campaigns many things to encourage the citizens to participate in discussions with the government. London's iconic lampposts are fitted with sensors and charging points for electric devices (Kosowatz, 2020).

The city of Barcelona, Spain, is famous for the constant innovation of technologies to maintain Barcelona as one of the best global cities. In 2011, Barcelona hosted the first 'Smart City Expo (Kosowatz, 2020) and 'World Congress for the promotion of a 'self-sufficient city' (Kosowatz, 2020) of productive citizens and its suburban neighbourhoods at human speed throughout a hyper-connected zero emission megacity area.

Hong Kong, China, pushed a major change to reform the city as a smart city in 2019. More than 70 initiatives have been launched to cover the city of Hong Kong, called 'smart government for smart economy.' City lampposts were fitted with sensors. The city has aimed to make them a 5G development. The 55-kilometer-long Hong Kong and Macao bridge is an outstanding example of connection and communication, one of the best features of smart city development (Kosowatz, 2020). One of the attractive initiatives of Hong Kong is a mobile-friendly city dashboard screen. The dashboard screen uses data from various government sources to show real-time images, maps, icons, and other information about the city.

5. CONCLUSION

The feature question is, what are the challenges for building smart cities in developing countries, and why are smart cities required as a process of the sustainable world? Building smart cities in developing countries needs infrastructure technology. One of the technologies is a sensor which collects data on everything from rush hour stats to crime rates to overall air quality for the maintenance of sensors. A Complicated and costly infrastructure is needed to



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maintain those sensors, which is very hard for production and utilization in developing countries. They lack the technologies to create such sensors and the techniques to keep them. Major metropolitan cities (Stone, 2018) in developing countries face reform problems because of their old infrastructure, such as transportation tunnels underground wiring steam pipes, to introduce a high-speed internet system. Security and hackers are another challenge for the smart city development program, especially when they hack information from sensors and shut down an entire city.

This is a big challenge in a smart city development program. Developing countries are out of those highly moderated technologies to protect their smart city from hackers. For a secured sensor program for the protection of information, developed countries are capitalizing hugely, which is possible due to high industrialization and economic solidarity.

Developing countries can not invest a lot of finance to secure smart city development programs. A smart city is even a dream for developing countries due to its lack of technological exploration, innovation, and financial maintenance. Education and Engagement (Stone, 2018) is another challenge in developing countries.

In developed countries, it is an inspiration throughout the launching of many governmental campaigns for the involvement of citizens in governmental activities. It is challenging in developing countries due to a lack of education and involvement initiatives. Citizens of developing countries are fighting poverty. It is, therefore, very hard for them to engage with the government to discuss a smart city development program. It could be a dream for them.

Social inclusion (Stone, 2018) is another issue in developing countries, which is almost nil in those countries due to a lack of collaboration between private initiatives, a lack of education and awareness among citizens and ignorance from all. Smart cities are essential and required for the globalized world for economic benefit, social inclusion, cultural innovation, and educational awareness.

Post-pandemic world demands for smart cities more than before due to a protective environment for the global citizens and the citizens of its urbanized areas. Therefore, more technological exploration and innovation are needed to create smart cities. In this context, the developed world must help developing countries build infrastructure and social inclusion through better education, awareness, and the distribution of health and well-being among citizens of developing countries.

Smart cities of developing countries can be a successful inclusion when developed and developing countries work together to create a better universe. There should not be any inequalities for a better livelihood among the citizens of both developed and developing countries.

Developed countries like Canada can help many developing countries with urbanization and infrastructure innovation. Edmonton has proved itself a major Canadian city, a world leader in leveraging technology and innovation to distribute an equal, exceptional life for its citizens. The city has a vast ecosystem for a friendly environment. It has an encouraging healthcare system, a carbon-neutral community, and many smart city development themes to encourage city people.

The City of Edmonton Council is a significant hub for the participation of citizens with the municipality as well as the provincial government. For this initiative, the City of Edmonton



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received the 'Gold Prize in the Open City Category of the We Go Smart Sustainable City Awards,' which promotes outstanding information and communication technology, smart city innovation plans and e-government. Therefore, it is hopeful that Canada is a humanitarian country with a tremendous record of helping poor and developing countries build smart cities for sustainable living.



City of Edmonton, Alberta, Canada, by my camera

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**THE KEY ISSUE ASPECTS, CHARACTERISTICS AND EFFECTS OF
ANTIOXIDANTS IN MISCELLANEOUS IMMUNOTHERAPEUTIC DIRECTIONS**

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ABSTRACT

Aim of the research was to study the key issue aspects, characteristics and effects of antioxidants in miscellaneous immunotherapeutic directions. Oxidation is a natural process. However, it can cause chain reactions that damage human cells. Antioxidants capture and release free radicals from the body and control lipid levels (especially cholesterol) in the blood. It has anti-cancer effect, stops the growth of cancer cells, and can also inhibit cancer cells. Stimulates and simultaneously activates the regeneration of normal and healthy cells. Supports normal platelet function and reduces blood viscosity. Provides free blood circulation in the vessels and promotes the elasticity of the vessels. Antioxidants have anti-inflammatory and antibacterial properties. Antioxidants keep the skin fair and supple and prevent premature aging. It has the ability to restore and regulate the growth of collagen fibers, restore youthfulness to the skin, anti-allergic by neutralizing the release of histamine, improve memory, increase the body's resistance to stress, and lower blood sugar levels. Vitamins, minerals, and enzymes called antioxidants can prevent these reactions. Antioxidants are considered an important part of a healthy diet that supports body systems, including connective tissue, respiratory, digestive, and cardiovascular systems. The best way to avoid deficiency is to get your daily dose of antioxidants from healthy plant foods like fruits and vegetables. However, you may need supplements to compensate for occasional oxidative stress (especially in elite athletes) or nutritional deficiencies. High levels of free



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radicals are the starting point for many diseases, from the common cough to cancer. Violations appear in the body, inflammatory processes develop, atherosclerosis develops, the digestive system is disturbed, malignant tumors, heart disease, etc. appear. The human immune system plays an important role in the fight against free radicals. The appearance of signs of aging is associated with a decrease in immunity and the action of free radicals: weakness in the muscles and skeleton, loss of skin elasticity, decreased functioning of the senses - hearing and vision, as well as problems and various mental processes. Propolis and flavonoids have been shown to inhibit IL-10, IL-4 and IL-13. IL-4 and IL-10 inhibit IL-12 induced IFN- γ secretion. In addition, IL-10 counteracts many of the pro-inflammatory effects of TNF- α and IL-1 β , while IFN- γ can inhibit monocyte production of IL-4 and IL-10.

Keywords: Characteristics, Effects, Antioxidants, Immunotherapeutic, Treatment, Directions.

1. INTRODUCTION

Reactive oxygen species (ROS) are produced by living organisms as a result of normal cellular metabolism. At low to moderate concentrations, they are involved in normal cellular processes, but at high concentrations, they cause harmful changes in cellular components such as lipids, proteins, and DNA. The shift in the balance of oxidants/antioxidants in favour of oxidants is called oxidative stress. Oxidative stress contributes to the development of many pathological conditions, including cancer, neurodegenerative diseases, atherosclerosis, hypertension, ischemia/reperfusion, diabetes, acute respiratory distress syndrome, idiopathic pulmonary fibrosis, COPD, and asthma. Aerobic organisms have built-in antioxidant systems, including enzymatic and non-enzymatic antioxidants, which are generally effective in preventing the harmful effects of ROS. However, under pathological conditions, antioxidant systems can be overloaded. In this review, we summarize the cellular mechanisms of oxidants and antioxidants, as well as redox and redox regulation in health and disease [1-3].

ROS are formed from molecular oxygen as a result of normal cellular metabolism. ROS can be divided into 2 groups: free radicals and non-radicals. Molecules that contain one or more unpaired electrons that make the molecule reactive are called free radicals. When 2 free radicals share their unpaired electrons, a non-radical is formed. The three main ROS of physiological importance is superoxide anion (O₂⁻), hydroxyl radical (-OH), and hydrogen peroxide (H₂O₂) [4-5].

Other oxygen-derived free radicals are peroxy radicals (ROO⁻). The simplest form of these radicals is the hydroperoxyl radical (HOO⁻), which plays a role in the peroxidation of fatty acids. Free radicals can initiate lipid peroxidation chain reactions by removing a hydrogen atom from the methylene carbon of the side chain. The lipid radical then reacts with oxygen to form a superoxide radical. The peroxy radical initiates a chain reaction that converts polyunsaturated fatty acids into lipid hydroperoxides. Lipid hydroperoxides are very unstable and rapidly break down into by-products such as aldehydes (eg 4-hydroxy-2,3-nom) and malondialdehyde (MDA). Isoprostanes are another group of lipid peroxidation products resulting from the peroxidation of arachidonic acid, and their increased concentration has also been found in the plasma and exhaled air of asthmatic patients. Lipid peroxidation disrupts the integrity of cell membranes and leads to the remodelling of membrane structure. Hydrogen peroxide, superoxide radicals, oxidized glutathione (GSSG), MDA, isoprostane,



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carbonyl, and nitrotyrosine can be readily determined in plasma, blood, or bronchoalveolar lavage samples as oxidative biomarkers using standard assays [6-8].

Fat-soluble vitamin E is concentrated in hydrophobic cells within the cell membrane and is the main defense against membrane damage caused by oxidants. Vitamin E donates an electron to the superoxide radical formed during lipid peroxidation. α -tocopherol is the most active form of vitamin E and the main antioxidant associated with the cell membrane. Vitamin E activates the cell division of cancer cells and inhibits the formation of free radicals [9-10].

GSH is present in all cellular compartments and is the main soluble antioxidant. The GSH/GSSG ratio is one of the main determinants of oxidative stress. GSH exhibits antioxidant activity in several ways. It neutralizes hydrogen peroxide and lipid peroxides through the action of GSH-Px. GSH donates its electron to H₂O₂ to be reduced to H₂O and O₂. GSSG is in turn reduced to GSH-by-GSH reductase, which uses NAD(P)H as an electron donor. GSH-Px is also important in protecting the cell membrane from lipid peroxidation. The reduced glutathione transports protons to membrane lipids and protects them from oxidative stress [11-12].

ROS can lead to DNA modifications in a variety of ways, including base degradation, DNA single- or double-strand breaks, purine-, pyrimidine-, or sugar-linked modifications, mutations, deletions or translocations, and cross-linking proteins. Most of these DNA changes are directly related to carcinogenesis, aging, neurodegenerative diseases, cardiovascular diseases and autoimmune diseases. Cigarette smoke, redox and non-redox metals such as iron, cadmium, chromium and arsenic are also involved in carcinogenesis and aging by forming free radicals or binding to thiol groups. The formation of 8-OH-G is the most well-known DNA damage due to oxidative stress and a potential biomarker of carcinogenesis [13-14].

Gene promoter regions contain homologous transcription factors. These transcription factor binding sites contain GC-rich sequences that are susceptible to oxidative attack. DNA synthesis of 8-OH-G at the transcription factor binding site can alter transcription factor binding and thereby alter the expression of associated genes, as shown for AP.1 and Sp-1 target sequences. In addition to 8-OH-G, 8,5'-cyclo-2'-deoxyadenosine (cyclo-dA) also inhibits cellular gene transcription when localized to the TATA domain. TATA-binding proteins initiate transcription by changing the bend of DNA. Binding to TATA-binding proteins can be disrupted by the presence of cyclo- α A [15-16].

Oxidative stress destabilizes microsatellite regions (short repeats). Redox-active metal ions and hydroxyl radicals increase microsatellite instability. Although single-stranded DNA breaks caused by oxidative damage are easily tolerated by cells, double-stranded DNA breaks caused by ionizing radiation can pose a serious threat to cell survival [17-18].

CpG group methylation in DNA is an important epigenetic mechanism that can lead to gene silencing. Oxidation of 5-MeCyt to 5-hydroxymethyluracil (5-OHMeUra) can occur via disaggregation/oxidation reactions of thymine or 5-hydroxymethylcysteine intermediates. It appears that in addition to regulating gene expression, DNA methylation also affects chromosome organization. Aberrant DNA methylation patterns induced by oxidative stress also affect DNA repair activity.



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ROS can induce lipid peroxidation and disrupt the assembly of membrane lipid bilayers, which can inactivate membrane-bound receptors and enzymes and increase tissue permeability. Lipid peroxidation products such as MDA and unsaturated aldehydes can inactivate many cellular proteins by forming protein cross-links. Nominative 4-hydroxy-2 depletes intracellular GSH and induces superoxide production, activates the epidermal growth factor receptor, and stimulates fibronectin production. Lipid peroxidase agents such as isoprostane and thiobarbituric acid-reactive agents have been used as surrogate biomarkers of oxidative stress, with increased concentrations detected in exhaled air or lung or pulmonary lavage in patients with COPD [19-20].

ROS can cause peptide chain fragmentation, change in protein electrical charge, protein cross-linking, and oxidation of certain amino acids, leading to increased susceptibility to proteolysis by degradation by specific proteases. Cysteine and methionine residues in proteins are particularly vulnerable to oxidation. Oxidation of sulfhydryl groups or methionine residues in proteins causes conformational changes, protein cleavage and degradation. Enzymes that have metals at or near their active sites are particularly susceptible to metal-catalyzed oxidation. Oxidative modification of enzymes has been shown to inhibit their activity [21-22].

In some cases, selective oxidation of proteins may occur. For example, methionine can be oxidized to methionine sulfoxide and phenylalanine can be oxidized to o-tyrosine. Sulfhydryl groups can be oxidized to form disulfide bonds, and carbonyl groups can be inserted into protein side chains. Gamma rays, catalyzed metal oxidation, HOCl and ozone can lead to the formation of carbonyl groups.

ROS can induce the expression of many genes involved in signal transduction. A high GSH/GSSG ratio is important to protect cells from oxidative damage. Violation of this ratio activates redox-sensitive transcription factors such as NF- κ B, AP-1, activated T-cell nuclear factor, and hypoxia-inducible factor 1, which participate in the inflammatory response. Activation of transcription factors by ROS occurs through signal transduction cascades that transfer information from outside to inside the cell. Receptor tyrosine kinases, most growth factor receptors such as epidermal growth factor receptors, endothelial growth factor receptors and platelet-derived growth factor receptors, protein tyrosine phosphatases and serine/threonine kinases are targets of ROS. The extracellular signal-regulated kinases, JNK and p38, which are members of the mitogen-activated protein kinase family and are involved in many cellular processes, including proliferation, differentiation and apoptosis, can also be regulated by oxidants [23-24].

Under conditions of oxidative stress, cysteine residues in the DNA binding site of c-Jun, some AP-1 subunits, and inhibitory κ B kinase are reversibly S-glutathionylated. Glutathione and TRX have been reported to play important roles in regulating redox signaling pathways such as NF- κ B and AP-1, mitogen-activated protein kinase p38, and JNK.

In allergic rhinitis, several recent studies have examined the function of the NF- κ B pathway in a mouse model of allergic rhinitis. Studies have shown that in an OVA-induced allergic rhinitis model, markers of oxidative stress such as MDA levels and the Nrf2 and NF- κ B pathways are elevated. They correlate with signs of inflammation such as cytokine levels and histopathological findings in models of allergic rhinitis. After treatment with the antioxidant mangiferin, the markers decreased [25-26].



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Most of the research on oxidative signaling pathways in allergic rhinitis has focused on finding potential dietary antioxidants as alternative pharmacotherapy options to combat this disease. Thus, the current literature is somewhat limited in defining the complex and diverse molecular pathways of specific oxidative stress in allergic rhinitis. Recent research on dietary antioxidants for the treatment of allergic rhinitis is discussed in detail, including the natural dietary sources of each antioxidant [27-28].

Antioxidants capture and release free radicals from the body and control lipid levels (especially cholesterol) in the blood. It has anti-cancer effect, stops the growth of cancer cells, and can also inhibit cancer cells. Stimulates and simultaneously activates the regeneration of normal and healthy cells. Supports normal platelet function and reduces blood viscosity. Provides free blood circulation in the vessels and promotes the elasticity of the vessels. Antioxidants have anti-inflammatory and antibacterial properties. Antioxidants keep the skin fair and supple and prevent premature aging. It has the ability to restore and regulate the growth of collagen fibers, restore youthfulness to the skin, anti-allergic by neutralizing the release of histamine, improve memory, increase the body's resistance to stress, and lower blood sugar levels [29-31].

Objectives

The aim of the research was to study and analyze the key issue aspects, characteristics and effects of antioxidants in miscellaneous immunotherapeutic directions.

2. METHODS

The material of the article was the data from scientific publications, which were processed, analyzed, overviewed and reviewed by generalization and systematization. Research studies are based on a review/overview assessment of the development of critical visibility and overlook of the modern scientific literature. Use the following databases (for extensive literature searches to identify key points related to antioxidant properties in antiallergic drug therapy): PubMed, Web of Science, Clinical key, Tomson Reuters, Google Scholar, Cochrane Library, and Elsevier Foundations. National and international policies and guidelines were also reviewed and as well as grey literature.

3. RESULTS and DISCUSSION

Propolis and its components are important for health protection, prevention and treatment of minor diseases. Propolis is an integral part of (bio)cosmetics and a natural antibiotic in the treatment of ear, nose and throat infections. The use of propolis is very wide and includes the food industry, medicine (as an immunomodulatory agent that heals wounds and burns), cosmetics and hygiene products. Despite the good properties of propolis, many studies have shown that it causes allergic reactions in people who are allergic to propolis components. Several experimental studies have shown varying degrees of response to propolis and its ingredients. Sensitivity to propolis has been demonstrated in European studies. Allergic reactions that have occurred: contact dermatitis, stomatitis, pharyngeal eczema, swelling of the lips, pain in the mouth, peeling of the lips and shortness of breath. Several allergens have been isolated from propolis, namely 3-methyl-2-butenyl caffeine, phenylethyl caffeine, benzyl caffeine, geranyl caffeine, benzyl alcohol, benzyl cinnamic acid, methyl cinnamic acid, ferulic acid, and tectoric acid. In addition, propolis appears to be one of the most



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common contact sensitizers and should be included in routine testing in children and adolescents prior to administration.

Propolis and its flavonoids are widely used in folk medicine as anti-inflammatory drugs and components of antifungal, antithrombotic, antiretroviral, antiallergic and anticancer drugs. Propolis has long been used in folk medicine. The anti-inflammatory effect of propolis is based on the inhibition of platelet aggregation, support for foot edema and arthritis in rats, the formation of eicosanoids, the production of cytokines and other important messengers to combat allergic diseases. Propolis is also known to have radiant properties. protects against damage to DNA by gamma and ultraviolet rays. For example, propolis protects the skin from many processes such as premature aging (wrinkles, flaking, dryness, capillary dilation and loss of collagen) and skin cancer. Particular attention should be paid to the therapeutic effect of propolis and its ability to induce the production of type I and III collagen and wound destruction. Propolis contains many compounds that speed up the healing process of the skin, such as tensile strength and elasticity, and promote the growth, expansion, and migration of human keratinocytes. These biochemical properties and changes in propolis may promote re-epithelialization and thus promise wound healing. It is worth noting that the use of propolis as a wound healing dressing has led to its economical, safe and painless use to protect against infections. Helps improve the rate of wound healing and reduce the number of dressing changes during micro healing. sewing materials and more. In a recent return to nature, modern man is looking for natural products with healing properties, mainly from plants and bees, which tend to fight allergies and/or inflammation. Laboratory and clinical studies of propolis, its related phytochemicals, as well as flavonoids and other antioxidants, indicate their use in the prevention and treatment of many diseases, including allergies. This review summarizes current knowledge about the mechanisms involved in the formation of the sensitizing and/or inflammatory potential of the polyphenolic/flavonoid components present in propolis, their importance in the treatment of allergic diseases, and their allergenic properties [32-34].

Propolis is widely used in folk medicine as an antioxidant and anti-inflammatory agent. Propolis has attracted the interest of scientists in elucidating its biological properties and discovering new treatments for many diseases such as diabetes, cancer, bacterial infections, allergic rhinitis and wounds. Propolis inhibited platelet aggregation, the formation of eicosanoids and supported arthritis, and also had a strong anti-inflammatory effect. Beneficial effect of propolis treatment in a child with eosinophilic ulcers. Recently, some studies have shown that propolis has important antibacterial properties in the saliva of periodontitis patients, while diphenyl-4-hydroxycinnamic acid, 3-prenyl-4-dihydrocinnamic acid and 22-dimethyl-6-carboxylic acid have been confirmed. be the main antibiotic with the highest activity against bacteria. Propolis can reduce dentin hypersensitivity (acute, sudden pain caused by tactile, osmotic, thermal, or other stimuli to exposed dentin) by reducing fluid conductivity in dentin. In addition, there is sufficient evidence that propolis and plant flavonoids, depending on their structure, can inhibit secretory processes, mitogen synthesis and intercellular processes, including their possible effect on the expression and activity of the original molecules. In addition, flavonoids can influence gene expression, pro-inflammatory cytokines, and cell receptors. The antioxidant and radical action of propolis and flavonoids helps fight allergic reactions and inflammatory processes. Several studies have shown that flavonoids can inhibit mast cell degranulation and reduce the release of



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histamine, tryptase, IL-6 and IL-8 from cultured mast cells and macrophages. In addition, some flavonoids have the ability to release histamine, leukotrienes, prostaglandin D₂, IL-4, IL-13 and GM-CSF from human mast cells and basophils in a concentration-dependent manner. All evidence to date suggests that flavonoids may have powerful anti-inflammatory and anti-allergic effects, especially in mast cell-mediated allergic inflammatory diseases such as allergic rhinitis, asthma, Alzheimer's, skin and gastrointestinal diseases [35-37].

Propolis and its compounds are effective against allergic diseases because many antioxidants inhibit the release of histamine from mast cells and basophils. Mast cells can be induced as long-lived cells by immunological or chemical methods. Mast cells and basophils expressing high-affinity IgE receptors play an important role in allergic inflammation by releasing chemical mediators such as histamine, heparin, serine proteases, cytokines, chemokines, prostaglandins, leukotrienes, and PAF. After IgE-mediated degranulation, mast cells can granulate, which is an important process in the development and duration of allergy.

Unlike the hypoallergenic properties of propolis described above, propolis does not interfere with the immune process of mast cell degranulation. Potential beneficial effects of propolis-based products as an adjuvant in patients with asthma. In particular, an ethanol solution of propolis showed better results than an aqueous solution in preventing mast cell degranulation. A possible explanation is that the ethanol solution contains a much higher content of flavonoids. These benefits may be related to the presence of caffeic acid (CA) derivatives such as caffeic acid phenethyl ester (CAPE) and other active ingredients in the extract. Propolis inhibited histamine release by a compound described as concanavalin A, suggesting an unknown flavonoid and anti-inflammatory compound. Propolis has shown an inhibitory effect on the activity of myeloperoxidase, ornithine decarboxylase, protein tyrosine kinase, NADPH oxidase, and hyaluronidase in guinea pig mast cells. This anti-inflammatory effect can be explained by the presence of active flavonoids and cinnamic acid derivatives such as acacetin, quercetin, naringenin and CARE and CA. An alcoholic extract of propolis (3, 10, 30, and 100 µg/mL) had no significant effect on the A23187 ionophore and ovalbumin-induced histamine release. Several authors have suggested that only high concentrations of propolis can directly activate mast cells, promoting the release of inflammatory mediators through cytotoxic mechanisms that may be associated with the allergic process in propolis-sensitive individuals [38-40].

Quercetin is extremely safe in the treatment of allergic rhinitis. Quercetin has many other beneficial properties (antioxidant, anti-inflammatory, capillary-stabilizing, etc.). It is a strong inhibitor of degranulation of basophils and mast cells. In an immune response, basophils and mast cells sensitized by cell surface-bound IgE antibodies are largely degraded after repeated exposure to allergens. Degranulation requires the supply of energy and calcium (Ca²⁺) and leads to the simultaneous release of histamine, adenosine triphosphate and other mediators stored in the granules. During degranulation, mast cells use calcium-activated enzymes to assemble contractile microtubules that pull granules up to the cell membrane, where inflammatory contents leave the cell and trigger an allergic reaction. Quercetin prevents mast cell degranulation by preventing Ca²⁺ from entering the cell. Due to the activity of phospholipase A₂, additional inflammatory mediators, such as metabolites of arachidonic acid, are released outside the cell. Steroids are known to act as anti-inflammatory agents due to their ability to inhibit phospholipase A₂. Quercetin also inhibits several steps in the membrane eicosanoid pathway, including phospholipase A₂ and lipooxygenase. Several



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authors have confirmed that quercetin can: (1) inhibit mast cell degranulation; (2) reduces airway hyperreactivity; (3) reduces mucus and collagen production; (4) reduces the recruitment of eosinophils and neutrophils; (5) reduce bronchial epithelial cell activation and expression of MMP-9 and MMP-12; (6) modulates the production of Th1/Th2 cytokines; (7) exhibits antifibrotic activity; (8) reduces collagen deposition by stimulating HO-1 activation; (9) reduces the production of IL-4, IL-5, CCL11 and LTB4 and increases IL-4 and increases the concentration of IFN- γ ; (10) reduces the synthesis of type I and type III collagen; and (11) regulates P-selectin expression by inhibiting NF signaling. These effects may be associated with attenuation of PI3 kinase, Akt and NF-kB signaling pathways. Quercetin, when combined with vitamin C, has been reported to reduce the symptoms of hay fever. Flavonoids have even been shown to inhibit enzymes that increase histamine release from mast cells and basophils: cAMP phosphodiesterase and calcium-dependent ATPase. Cyclic AMP phosphodiesterase cleaves cAMP; a large amount of cAMP blocks intracellular histamine stores. In addition, calcium-dependent ATPase breaks down ATP, releasing energy and promoting the release of Ca²⁺ from the cell membrane; High levels of intracellular Ca²⁺ also cause the release of histamine from storage granules. Quercetin has a high affinity for mast cells and basophils; stabilizes membranes, prevents the release of histamine, and may inhibit two enzymes that control the release of leukotrienes involved in the asthmatic response. By blocking the release of histamine and leukotrienes into the bloodstream, quercetin prevents allergy symptoms such as nasal swelling, nasal congestion, sneezing, watery eyes, and itchy eyes and nose [41-45].

The mechanism of the allergenic action of flavonoids, such as luteolin, quercetin and baicalein, which participate both in the IgE-mediated immune response and in the sensitization and action phase, is based on their structure and ability to inhibit: (1) hexosaminidase enzyme; as a key factor in reducing mast cell degranulation), phospholipase A2 (PLA2) and 5-lipoxygenase (5LO). (2) transport of ATPase for histamine secretion by rat mast cells. (3) human basophils stimulated by allergens; (4) Synthesis and secretion of cytokines IL-4, IL-13 and CD40 ligand (important for the differentiation of B-lymphocytes into IgE-producing cells), granulocyte-macrophage colony-stimulating factor, GM-CSF, interleukin (IL)-6 and tumors with necrosis factor (TNF)- α . At present, many of the mechanisms by which flavonoids inhibit histamine synthesis and release in response to high-affinity IgE receptor (Fc ϵ RI) cross-linking are unclear and require further investigation. According to many researchers, due to their antioxidant and anti-allergenic properties, flavonoids can inhibit the formation and release of many allergic mediators, including Th2-type cytokines (IL-4 and IL-13), as well as CD40 expression. an important ligand in many intercellular interactions. These cells (such as mast cells and basophils) express the immunoglobulin E (IgE) receptor with high affinity, leading to an increased inflammatory response. It turns out that to produce IgE, B cells need to receive two signals. the first signal comes from the cytokines IL-4 and IL-13, and the second comes when CD40L, which is induced on the surface of T cells after allergen exposure, binds to CD40 on the cell surface. is important for activation and induction of allele exchange in B cells. Reactive T cells, when encountering an allergen, express CD40L and can therefore target B cells, monocytes, DCs and epithelial cells using CD40. Polyphenol-flavonoid compounds control the Th1/Th2 balance and inhibit the formation of antigen-specific IgE antibodies by influencing the formation of allergic-IgE complexes and binding this complex to its receptor (Fc ϵ RI) on mast



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cells and basophils. In addition to Th2 cells, tannins isolated from apples can prevent food allergy by increasing the number of $\gamma\delta$ TCR T cells in intestinal epithelial lymphocytes.

It has been shown that the inhibitory effect of some flavonoids on mast cell degranulation results from the modulation of Ca^{2+} receptor channels in the cell membrane and β -exosaminidase as a marker of mast cell degranulation. For example, apigenin, luteolin, 3,6-dihydroxyflavones, fisetin, kaempferol, quercetin and myricetin have been found to inhibit hexosaminidase release from mast cells with IC50s less than 10 μ M, while quercetin, quercetin, scutellarin inhibit PLA2 with IC50s in the range 12.2 to 17.6 μ M. In addition, luteolin, apigenin and fisetin are the most potent inhibitors of IL-4 and IL-13 synthesis, while 3-hydroxyflavone, kaempferol, quercetin, eriodictyol, futin and 7-hydroxyflavone also inhibit IL-4 production, but to a lesser degree. Classification. Classification. Sirsilol (3',4',5-trihydroxy-6,7-dimethoxyflavone) produced 97% inhibition of 5LO activity in rat basophils and 99% inhibition of cysteinyl leukotriene release from rat and guinea pig lungs. In particular, quercetin and kaempferol can inhibit IL-4 synthesis with an IC value of 15.7–18.8 μ M. Inhibitory effects of kaempferol on the biological activity of IL-5 and histamine release from basophils and mast cells. Hydroxylation of IL-4, 7 and 4' and the presence of OH at position 3 or 5 are required for maximal inhibition, whereas glycosylation at position 3 reduces activity [46-48].

By inhibiting IL-4 mediated signaling, flavonoids prevent differentiation of primary CD4+ T cells into effector T cells by inhibiting aryl hydrocarbon receptor (AhR) and NF- κ B activation. AhR is a ligand-activated transcription factor that mediates the toxic and biological effects of many aromatic environmental pollutants such as dioxin.

The antioxidant activity of flavonoids is mediated by nuclear factors/AhR in association with erythroid factor 2 (Nrf2) and results in increased activity of antioxidant enzymes such as peroxidase, glutathione peroxidase, catalase, peroxiredoxin, and heme oxygenase-1. By reducing oxidative stress, propolis and its flavonoids can inhibit the oligomeric nucleotide-binding domain, the leucine-rich repeat gene family, and the pyrine domain-containing inflammasome 3 (NLRP3) [49-50].

The anti-inflammatory effects of flavonols (quercetin, rutin and morin) and flavanones (hesperetin and hesperidin) have been studied in animal models of acute and chronic inflammation. The anti-inflammatory potential of propolis and its flavonoids is attributed to several mechanisms, such as: (1) strong antioxidant activity and free radical scavenging, (2) regulation of inflammatory cell activity, (3) inhibition of arachidonic acid, a metabolic enzyme (phospholipase). A2, COX, LOX) and nitric oxide synthase, (4) regulating the production of pro-inflammatory cytokines and mediators and (5) downregulating the expression of pro-inflammatory genes. It should be noted that the main flavonoid processes that determine anti-inflammatory activity consist of: (1) inhibition of pro-inflammatory enzymes (COX, LOX, and inducible NO synthase); 2) inhibition of NF- κ B transcription factors and activation of protein -1. (AP-1); (3) activation of phase II detoxification enzymes by antioxidant factors including glutathione reductase, glutathione peroxidase, heme oxygenase, γ -glutamylcysteine synthetase, superoxide dismutase, and catalase; and (4) modulating signalling pathways such as protein kinase C, mitogen-activated protein kinase (MAPK), and erythrocyte nuclear factor-associated factor 2 (Nrf2), whose protein products are involved in detoxification and "elimination of reactive and electrophilic oxidants through functional conjugation reactions." and increase the oxidative capacity of cells, its action leads



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to inhibition of MCP-1 expression and adhesion of moth 1 cells, adhesion of monocytes to endothelial cells, as well as migration and activation of p38 MAPK [51-53].

The document confirmed the anti-inflammatory effects of propolis and flavonoids such as quercetin, luteolin, anthocyanins, hyperin and alpinetin on the TLR4/NF- κ B/NLRP3 signalling pathway. It is based on interfering with several steps of NLRP3 inflammatory signaling in vitro and in vivo, reducing and/or inhibiting the expression of pro-inflammatory NLRP3 factors such as IL-1 β , IL-18, NLRP3 and caspase-1 β . Oligomerization with signalling molecules (eg, TLR4/NF- κ B/NLRP3, PPAR γ , TXNIP, and Syk/Pyk2). For example, EGCG reduces peritonitis by inhibiting NLRP3 expression and IL-1 β release in mice treated with NMSUL sodium urate crystals in NMSUL3 crystals) binds to a thioredoxin-interacting protein (TXNIP) in THP-1 cells, while quercetin inhibits NLRP3 expression and IL-1 β and caspase-1 activity in human colon epithelial cells [54-55].

The anti-inflammatory mechanism of resveratrol is based on its ability to remove ROS, inhibit COX, and activate several pro-inflammatory signaling pathways, including sirtuin-1 (Sirt1), which inhibits TLR4/NF signaling. κ B/STAT, which leads to a decrease in the production of cytotoxic and pro-inflammatory factors by passive immunity cells, macrophages and mast cells. Therefore, the addition of resveratrol to the human diet may be promising for the treatment of immune diseases, but only in the form of nanoparticles due to its rapid metabolism in the body.

Despite the low gut bioavailability of flavonoids and hence low effective plasma and target tissue concentrations, even low flavonoid concentrations appear to be sufficient to activate Keap1/Nrf2/ARE and Keap1/Nrf2/ARE NF- κ B signaling as main factor. . health improvement system. The main mechanisms of anti-inflammatory action of flavonoids in the intestine are: (1) strong antioxidant properties and/or radical scavenging, (2) the effect of nitric oxide (NO) on metabolism, (3) inhibition of anti-inflammatory processes. effect, (4) inhibition of lipoxygenase and reduced production of leukotriene B4 (LTB4), (5) preservation of colonic absorption, and (6) influence of TLR and inflammation. Therefore, it is possible that propolis and its flavonoids are suitable compounds for limiting or even preventing the development of allergic/inflammatory reactions.

Propolis and flavonoids have been shown to inhibit IL-10, IL-4 and IL-13. IL-4 and IL-10 inhibit IL-12 induced IFN- γ secretion. In addition, IL-10 counteracts many of the pro-inflammatory effects of TNF- α and IL-1 β , while IFN- γ can inhibit monocyte production of IL-4 and IL-10 [56-58].

There is growing evidence of an important role for arginase in patients with asthma. Arginase 1 expression and arginase and/or arginase activity are elevated in the airways and serum of asthmatic patients, and there is a correlation between arginase expression in bronchial brushes, serum arginase activity, plasma concentrations of L-arginine and its metabolites, and disease severity. lung function) and Fe (NO). In addition, ARG1 and ARG2 polymorphisms are associated with asthma, asthma severity (pulmonary function, AHR), and decreased response to β 2-agonists and glucocorticoids. In addition, recently there has been an increase in the expression of arginase 1 and 2 in the nasal mucosa and the activity of arginase in the blood serum.

Considered alternative medicine, herbal medicine is one of the complementary methods using natural extracts as medicines or treatments. In recent years, much attention has been paid to



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natural products in disease prevention due to their many health benefits and remarkable lack of toxicity and side effects. Many plant foods, such as grains, nuts, cereals, soybeans, spices, flaxseeds, fruits, vegetables, medicinal plants, and herbs, contain various phytochemicals such as phenols, carotenoids, alkaloids, nitrogen and organosulfur compounds, and vitamins [59-61].

Recent *in vivo* and *in vitro* studies have demonstrated the potential anti-inflammatory role of some known natural antioxidants. Combinations of natural antioxidants provide various mechanisms to reduce tissue oxygen metabolites, modulate signaling pathways, and regulate transcription factors, and may play a key role in reducing species-dependent reactive oxygen species (ROS) damage. Many bioactive plant compounds, including several polyphenols, have recently been tested for vascular disease.

Asthma and chronic obstructive pulmonary disease (COPD) are chronic inflammatory airway diseases characterized by bronchial hyperreactivity and airflow limitation with acute bronchospasm, airway inflammation, chronic mucositis, and airway wall remodeling. Significant evidence suggests that oxidative stress, one of the causes of asthma, acts as a central event in the inflammatory response by activating transcription factors such as nuclear factor- κ B (NF- κ B) and protein-1 (AP-1), mediators of pro-inflammatory gene expression. Thus, bioavailable antioxidants can protect against the direct harmful effects of oxidants and fundamentally alter inflammation in the pathogenesis of various respiratory diseases [62-64].

The lungs have several natural antioxidant mechanisms to counteract the overproduction of oxidants (ROS, reactive nitrogen species, and lipid peroxides), including enzymatic and non-enzymatic antioxidants. These antioxidant defense systems form a tightly regulated network that resists any changes in the redox environment of the intracellular and extracellular spaces. Enzymatic antioxidants include catalase, glutathione peroxidase (GPX), and superoxide dismutase (SOD), while non-enzymatic antioxidants include vitamin C, vitamin E, albumin, uric acid, ceruloplasmin, and glutathione (GSH). Changes in these enzymatic and non-enzymatic antioxidants can alter ROS homeostasis in bronchial cells [65-67].

Deficits in intrinsic antioxidant defense have been reported in asthma. Devereux and colleagues hypothesized that people in Western societies gradually reduce their intake of fruits and vegetables, thereby reducing the antioxidant defenses of the lungs, making them more sensitive to inhaled irritants and allergens. Since many antioxidants are obtained from food, particular attention is being paid to the availability of antioxidants (vitamins A, C and E, polyphenols and carotenoids) and how they can help protect people suffering from dementia, oxidative stress and/or airway inflammation.

Plants have two main mechanisms for detoxifying harmful oxidants. One of them is the direct enzymatic cleavage of oxidative radicals using SOD, catalase, ascorbate peroxidase, peroxidase, glutathione reductase, and monodehydroascorbate reductase. These enzyme systems convert various oxidative radicals into reduced products. The second method is to create antioxidant molecules such as vitamin C and vitamin E. These antioxidant compounds have a hydroxyl group (-OH) in an electron-deficient ring structure that is highly sensitive to ROS [68-70].

The active ingredient in turmeric is curcumin, a polyphenolic plant substance with anti-inflammatory, anti-amyloid, antiseptic, anti-cancer, anti-allergic, and antioxidant properties. In addition to its use in cooking, curcumin has been used as a folk remedy for liver disorders



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(especially jaundice), indigestion, urinary tract disorders, blood cleansers, arthritis (rheumatism), insect bites, skin disorders, and atherosclerosis. Curcumin has been shown to be eight times more effective than vitamin E in preventing lipid peroxidation. Curcumin is also believed to play a role in reducing oxidative stress by inhibiting the formation of nitric oxide (NO), scavenging or neutralizing free radicals, especially superoxide anions, and inhibiting free radical-induced oxidative chain reactions [71-73].

α -lipoic acid (LA), an organosulfur compound derived from octanoic acid, is a naturally occurring compound also known as thioacid. LA is readily absorbed from food and rapidly converted to the reduced form of dithiol, dihydrolipoic acid (DHLA). LA and DHLA are powerful antioxidants. Most of the LA in food is processed by lipoamide-containing enzymes and is associated with the amino acid lysine (lipopolysin). Plant sources rich in lipopolysin include spinach, broccoli, and tomatoes. LA is a non-vitamin nutrient essential for life. It is not classified as a vitamin because it is produced in the body. It is often involved in the oxidative decarboxylation of keto acids and has been shown to be a growth factor in some organisms. While LA is involved in cellular energy production, its primary role as a dietary supplement may be as a powerful antioxidant. Unlike other antioxidants, LA is soluble in fats and water, easily absorbed and transported through cell membranes. LA directly quenches reactive oxygen species, regenerates/recycles endogenous and exogenous antioxidants such as vitamins C and E and GSH, removes redox metals including Cu(II) and Fe(II), restores oxidized proteins and regulates the activity of transcription factors, those like NF- κ B and LA have the ability to regenerate other antioxidants such as vitamin C, vitamin E and GSH for later use after free radical scavenging [74-77].

An antioxidant is a molecule that prevents the oxidation of other molecules. Oxidation releases free radicals, which scientists believe cause many diseases. When the body receives enough antioxidants, it can fight free radicals on its own. In fact, the antioxidants, minerals, fiber, and other substances found in fruits, vegetables, and grains protect the body from disease, but taking large doses of additional antioxidants does not have much effect. Among the substances that act as antioxidants against harmful free radicals, the most common are vitamin A, vitamin C, vitamin E, selenium, flavonoids, lignan, and lutein. Sources of vitamin E are nuts, cereals, vegetables and vegetable oil. Sources of vitamin C include citrus fruits, tomatoes, green leafy vegetables, and strawberries. Sources of vitamin A include apricots, melons, broccoli, sweet potatoes, carrots, cabbage, and plums. Sources of selenium: nuts, fish, red meat, cereals, eggs, garlic and milk. Sources of flavonoids: soy, red wine, pomegranate, blackberry, currant and tea. Sources of lignans are flaxseed, barley, rye, whole grains, and oats. Sources of lutein: kiwi, spinach, Brussels sprouts, green tea and broccoli.

Antioxidants are substances that protect the human body from harmful particles and especially from free radicals. Free radicals are unstable, highly aggressive and active molecules that damage healthy cells and cause: frequent colds and flu, exacerbation of chronic diseases, premature aging of the body, the risk of atherosclerosis, heart attack, accidents, cerebrovascular diseases, cataracts and cancer. Antioxidants can be called the ecological side of the human body. These are "C", "E", vitamin A, lupine, lycopene, some amino acid complexes, the trace element selenium and some plant extracts. Plant foods are the main source of antioxidants. These are fruits, vegetables, herbs, green tea and much more. These products also contain a large number of vitamins, minerals and other biologically active substances necessary to keep the body in good shape.



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It is believed that vitamin A and the retinoic acid produced from it protect the body from surrounding carcinogens. Carotene is formed from vitamin A. American scientists have proven that foods rich in carotene protect against cancer. Colourful fruits and vegetables contain a lot of carotenes. With a sufficient amount of vitamin-A in the body, the skin becomes healthy and smooth, and the vessels remain elastic since this vitamin prevents the formation of loops in the vessels [78-80].

The activated mineral zeolite (clinoptilolite) 500 mg "Geomin Forte" developed and characterized by an antioxidant effect. Unlike traditional antioxidants, it stimulates the body's antioxidant system and is a direct antioxidant. The activated natural mineral zeolite (clinoptilolite) acts directly on the cell membrane as a surfactant, which is an electron donor. Geomin Forte is 200 times more antioxidant than vitamins C and E. Geomin Forte can be used for poisoning (used as the best food absorbent), infections, occupational poisoning, chronic metal poisoning and chronic exposure and also against the functional state of the immune system over time and in any case, with allergic diseases.

One of the most powerful antioxidants is vitamin C (ascorbic acid). Vitamin E, which is assigned the role of a fat solvent, traps free radicals in the membrane, which consists of lipid molecules, and ascorbic acid performs this work in the water space between cells. Vitamin C also works in the circulatory system, protecting hemoglobin from oxidation, providing iron stores in the body, and regulating cholesterol levels. The human body can absorb 2-3 g per day, the excess is excreted by the kidneys. However, taking vitamin C in large quantities is not recommended, practice shows that this will not lead to anything good. High concentrations of vitamin C are found in asparagus, peas, beets, black currants, cabbage, cherries and strawberries.

Selenium provides antioxidant protection and slows down aging. Selenium improves mobility and regulates thyroid function. Selenium-rich beef and pork liver and kidneys, fish and plant products - wheat bran, wheat seeds, legumes, sunflowers, nuts, corn, tomatoes, mushrooms, garlic and whole grain bread. Lycopene is one of the most powerful carotenoids and has been shown to protect against breast, lung, endometrial and prostate cancer. Contains mainly tomatoes and tomato puree (1 tablespoon covers full daily dose).

Taking into account the above properties of the zeolite mineral (clinoptilolite), the activated clinoptilolite 500 mg "Geomin Forte" developed by us is characterized by an antioxidant effect. Unlike traditional antioxidants, it stimulates the body's antioxidant system and is a direct antioxidant. The activated natural mineral zeolite (clinoptilolite) acts directly on the cell membrane as a surfactant, which is an electron donor. Geomin Forte is an antioxidant, 200 times stronger than vitamins C and E. This allows it to be used for poisoning (it is used as the best absorbent for food poisoning, infectious, occupational, chronic metal poisoning and chronic exposure). And also, against the background of the functional state of the immune system for a long time and to help with allergic diseases.

Alpha Lipoic Acid is a general antioxidant that protects against oxidation and helps remove toxins from the body. Alpha lipoic acid may increase physical endurance. Alpha lipoic acid is also found in spinach, rice, and kale, as well as animal products containing animal acids: heart, liver, kidney, milk, eggs, and beef.



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Green tea and cranberry extract contain a large number of polyphenols and flavonoids, very powerful natural antioxidants with a wide spectrum of action.

Lutein protects the retina by absorbing harmful UV rays. Lutein may reduce the risk of retinal degeneration, which is a cause of age-related blindness. Several large studies have shown that people who consume a lot of lutein have a lower risk of developing cataracts.

Lutein is found in dark green leafy vegetables such as spinach, kale and broccoli, various fruits and breads. Carrots, zucchini and other vegetables containing orange and yellow pigments, as well as egg yolks, are also sources of lutein. All of these foods are an important part of a healthy diet. However, it is difficult to get enough lutein daily from a regular diet, as most foods are very low in lutein. Therefore, an important source of lutein are specially prepared natural preparations - biologically active food supplements, standardized according to the content of this active food supplement.

Antioxidants are essential for the survival of all organisms. The human body produces its own antioxidants. For example, glutathione is a cellular antioxidant. Plants and animals, like all other life forms, have their own defense mechanisms against free radicals and oxidative damage. Thus, antioxidants are found in all whole foods of plant and animal origin, and an adequate intake of antioxidants is important. In fact, human life depends on the intake of certain antioxidants, namely vitamins C and E.

Oxidation is a natural process. However, it can cause chain reactions that damage human cells. Vitamins, minerals, and enzymes called antioxidants can prevent these reactions. Antioxidants are considered an important part of a healthy diet that supports body systems, including connective tissue, respiratory, digestive, and cardiovascular systems. The best way to avoid deficiency is to get your daily dose of antioxidants from healthy plant foods like fruits and vegetables. However, you may need supplements to compensate for occasional oxidative stress (especially in elite athletes) or nutritional deficiencies.

Simply put, free radicals are highly reactive molecules that have a place for electrons and try to fill it by taking electrons from other molecules. Filling the free space makes it safe, but it has already done its "dirty" work. Having lost an electron, the molecule turns into a free radical and continues to fill the need for the missing electron. Free radical molecules are constantly formed in the human body due to a variety of redox processes that ensure the proper functioning of all organs and systems.

Under natural conditions, the number of free radicals is small and their pathological effect on the cells of the body is suppressed by antioxidants (when eating foods containing these substances). However, in case of metabolic disorders, under the influence of toxins, the protection of antioxidants weakens, the balance of the cell is disturbed, and the number of free radicals increases significantly.

High levels of free radicals are the starting point for many diseases, from the common cough to cancer. Violations appear in the body, inflammatory processes develop, atherosclerosis develops, the digestive system is disturbed, malignant tumors, heart disease, etc. appear. The human immune system plays an important role in the fight against free radicals. The appearance of signs of aging is associated with a decrease in immunity and the action of free radicals: weakness in the muscles and skeleton, loss of skin elasticity, decreased functioning of the senses - hearing and vision, as well as problems and various mental processes.



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4. CONCLUSIONS

Antioxidants are essential for the survival of all organisms. The human body produces its own antioxidants. For example, glutathione is a cellular antioxidant. Plants and animals, like all other life forms, have their own defense mechanisms against free radicals and oxidative damage. Thus, antioxidants are found in all whole foods of plant and animal origin, and an adequate intake of antioxidants is important. In fact, human life depends on the intake of certain antioxidants, namely vitamins C and E. Taking into account the above properties of the zeolite mineral (clinoptilolite), the activated clinoptilolite 500 mg "Geomin Forte" developed by us is characterized by an antioxidant effect. Unlike traditional antioxidants, it stimulates the body's antioxidant system and is a direct antioxidant. The activated natural mineral zeolite (clinoptilolite) acts directly on the cell membrane as a surfactant, which is an electron donor. Geomin Forte is an antioxidant, 200 times stronger than vitamins C and E. This allows it to be used for poisoning (it is used as the best absorbent for food poisoning, infectious, occupational, chronic metal poisoning and chronic exposure).

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THE MANIFESTATION OF FEATURES OF FACTORS EFFECT ON DENTAL HYGIENE, ORAL HEALTH AND DENTAL EDUCATION OF COMMON PEOPLE

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ABSTRACT

The aim of the research was to study and analyze the features of factors effect on dental hygiene, oral health and dental education of common people. The importance of evidence-based treatment and developed ways to implement data science systematically through funding, education, and fellowships. The translation of new knowledge discovered by big data analytics into evidence-based dental practice has potential to improve public oral health outcomes. Precision public health has been defined as a method to improve the ability to prevent disease, promote health, and reduce health disparities in populations by applying emerging methods and technologies for measuring disease, pathogens, exposures, behaviors, and susceptibility in populations; and developing policies and targeted implementation programs to improve health. Appropriate oral hygiene behavior, including frequent daily tooth brushing, using dental floss, and receiving regular dental checkups, can help prevent dental caries and periodontal disease. Oral hygiene behavior is related to a variety of factors, including oral hygiene knowledge. Furthermore, it has been reported that students who had acquired dental knowledge during the university life improved their oral health status. In health care globally, there has been a focus on person-centered care, which is an individualized, holistic approach to care where the



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decision making is shared by the clinician and the client, and at times, includes the client's family or caregiver. Instead of viewing the client as a collection of symptoms, person-centered care fosters communication to take into consideration the client's values and goals. Dental hygienists have an ethical responsibility to provide opportunities for patients to make informed decisions about their treatment. Diagnosis refers to the identification of a disease based on the presentation of signs and symptoms. Health care professionals in all fields use diagnosis as a means to identify and discuss diseases with patients and formulate a plan for treatment.

Keywords: Features, Factors, Effect, Dental Hygiene, Oral Health, Dental Education.

1. INTRODUCTION

Dental hygiene education has been increasing in recent years. Evidence suggests that baccalaureate dental hygiene graduates have greater depth and breadth of knowledge, improved cognitive abilities related to research use and critical thinking, increased confidence to take action in their practice resulting in greater contributions in interprofessional contexts, and more career opportunities outside of private clinical practice. Studies have also demonstrated that baccalaureate dental hygiene graduates are more likely to practice in alternative settings, such as public health authorities and other community agencies, hospitals, educational institutions, professional associations and regulatory bodies, research laboratories, industry, and independent practice [1-3].

Appropriate oral hygiene behavior, including frequent daily tooth brushing, using dental floss, and receiving regular dental checkups, can help prevent dental caries and periodontal disease. Oral hygiene behavior is related to a variety of factors, including oral hygiene knowledge. In Japan, previous studies reported that university students with better oral hygiene knowledge practiced better oral hygiene behavior. In other countries, similar results have been reported. Furthermore, it has been reported that students who had acquired dental knowledge during the university life improved their oral health status [4-5].

Children's quality of life, academic performance, and future achievement can all be negatively affected by poor dental health. The present study aimed to assess the need for dental health services and the factors influencing their utilization using the Andersen health care utilization model among school children. Dental caries is the most critical indicator of oral health, while dental appointments are a marker of dental care. The school setting is thought to be the most efficient approach to reaching out to children's families and communities.

Despite the preventive nature of oral diseases and their significance for general wellbeing, poor oral health is highly prevalent and has unfavorable ramifications for children around the world. Indigenous children in Australia experience disproportionate rates of early childhood caries compared to their non-Indigenous counterparts. Therefore, the paper collates parental experiences and generate an understanding of facilitators for Indigenous childhood oral health. Child-level facilitators include oral hygiene routines and regular water consumption. Family-level facilitators include familial ties, importance of knowledge, and positive oral health beliefs. Community-level facilitators include generational teaching, helpful community resources, and holistic health care. Recommendations from findings include the following: exploration of Indigenous health workers and elder participation in oral health initiatives; inclusion of Indigenous community representatives in mainstream oral health discussions; and incorporation of child-level, family-level, and community-level facilitators to increase support for efficacious oral health programs [6-9].



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Compromised nutritional intake due to eating disorder related behaviors, such as binge eating and purging, can lead to multi-system medical complications, including an irreversible impact on oral health. However, dental anxiety, fear or embarrassment may hinder individuals with an eating disorder from seeking assistance for their oral health concerns. As key health professionals in eating disorder treatment, dietitians are well positioned to provide basic dental screening, however, their capacity to perform this role in practice has not been established. The aim of this review was to identify current evidence on the role of dietitians in promoting oral health among individuals with eating disorders [10-12].

Eating disorder related behaviors including binge eating and purging are known to lead to significant medical and dental complications. Barriers including dental anxiety or embarrassment may hinder individuals with an eating disorder from seeking assistance for their oral health concerns. Dietitians form part of the primary care team for eating disorders and therefore are well positioned to provide basic dental screening and education, however, their capacity to perform this role in practice has not been established. A review of the literature was conducted and focused on guidelines for oral health promotion, dietitian knowledge, attitudes and practices towards oral health promotion, and the availability of resources in this area. Recommendations that supported the role of the dietitian in oral health promotion were identified. Additionally, dietitians were found to be aware of the importance of oral health, however were not providing referrals. Overall, there was limited evidence of adequate oral health resources to assist dietitians. Despite the limited evidence, it highlights their capability to provide pre-emptive oral health promotion in other clinical settings. Further research is needed to explore how to support dietitians to promote oral health among populations with an ED [13-15].

Vitamin D is synthesized in the skin after exposure to natural sunlight or absorbed through the dietary and supplemental intake. The vitamin D status depends on several factors such as pigmentation of the skin, amount of sun exposure, the latitude of living, season, vitamin D intake, age, sex, overweight/obesity, malabsorption, and medication such as corticosteroids. Receptors for vitamin D are expressed in many types of tissues and cells, indicating a potential influence on several biological processes, such as modification of the adaptive and innate immune system, with anti-microbial and anti-inflammatory effects, and suppression of autoimmune responses. Inadequate vitamin D levels have been associated with several extra-skeletal, and autoimmune diseases and chronic pain conditions. Vitamin D plays a crucial role in preserving phosphate and calcium homeostasis and enables normal mineralization, growth, and bone remodeling. Long-lasting vitamin D deficiency may lead to rickets, muscle weakness, bone pain, and growth impairment in children. Vitamin D deficiency has also been linked to enamel defects and increased risk of dental caries. The development and mineralization of both the baby's primary teeth during pregnancy and permanent teeth after birth are vulnerable to disturbances in vitamin D and mineral metabolism. This is supported by a recent mother-baby pair study where maternal vitamin D levels (< 50 nmol/L) during the third trimester of pregnancy, were associated with higher caries experience in the primary dentition of children at 6 years of age compared to children of mothers with sufficient third-trimester vitamin D levels. Vitamin D may also influence oral health conditions through its anti-inflammatory and anti-microbial effects. Studies of serum vitamin D status in children and adolescents with Juvenile Idiopathic Arthritis (JIA) are often characterized by small sample sizes and a lack of healthy controls and show inconsistent results regarding serum vitamin D levels, the prevalence



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of insufficiency and deficiency, and the association between serum vitamin D status and disease activity. However, inadequate vitamin D levels appear to be common among young individuals with JIA. Serum vitamin D levels, JIA activity, and oral health conditions might be affected by ethnicity, lifestyle, dietary habits, socio-economic and environmental factors, and also genetics [16-17].

Objectives

The aim of the research was to study and analyze the features of factors effect on dental hygiene, oral health and dental education of common people.

2. METHODS

The material of the article was the data from scientific publications, which were processed, analyzed, overviewed and reviewed by generalization and systematization. research studies are based on a review/overview assessment of the development of critical visibility and overlook of the modern scientific literature. use the following databases: (for extensive literature searches to identify the manifestation of features of factors effect on dental hygiene, oral health and dental education of common people). PubMed, web of science, clinical key, Tomson Reuters, google scholar, Cochrane library, and Elsevier foundations. national and international policies and guidelines were also reviewed and as well as grey literature.

3. RESULTS and DISCUSSION

Digital dentistry and superior visualization for diagnosis are used in dental practices and are becoming more efficient as a result of technological advances. In dentistry, dental informatics relates to information management, communication, and the deployment of new technologies in clinical practice and research. Management of information in a dental office includes storing and using information generated while working directly with patients, arranging visits, and running dental practices. The dental office uses this system as an information management system. The existence of information systems is a prerequisite for all human creativity today.

The best care for an individual, precision medicine takes various factors into account in addition to disease history, such as an individual's environment, genome, and socioeconomic status. By combining these elements, a profile can be generated for each individual that better predicts their health outcomes and addresses risk factors. Combined information provides an opportunity to tailor treatment to the needs of the individual patient based on their risk factors. To successfully integrate precision medicine into oral healthcare, three major challenges must be addressed: development of up-to-date evidence-based guidelines, integration of large analytical data sets, and translation of new knowledge into routine clinical care delivery. In the fields of dentistry and oral health, implementation of these factors represents a major obstacle to the delivery of precision oral medicine [18-20].

The World Dental Federation's (FDI's) theoretical framework of oral health builds on the World Health Organizations' Commission on Social Determinants of Health report and includes individual, environmental, and social determinants of oral health through a life course. A central part of the FDI's framework, the core elements of oral health, refers to progression, impact, and severity of diseases and conditions as well as the abilities, functions, and capacities related to oral health. In addition, the framework includes these components: overall health and well-being, moderating factors, and driving determinants. Altogether, the framework describes oral



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health status, the connection to overall health and well-being, and elements that can determine or affect how an individual scores their oral health, as well as factors that can affect it [21-22].

The importance of evidence-based treatment and developed ways to implement data science systematically through funding, education, and fellowships. The translation of new knowledge discovered by big data analytics into evidence-based dental practice has potential to improve public oral health outcomes. Precision public health has been defined as a method to improve the ability to prevent disease, promote health, and reduce health disparities in populations by applying emerging methods and technologies for measuring disease, pathogens, exposures, behaviors, and susceptibility in populations; and developing policies and targeted implementation programs to improve health [23-25].

Previous studies suggest that a family member should be psychologically prepared to respond to health dangers or circumstances. The number of dental clinic visits in a year is used as a standard measure to analyze dental health service (DHS) utilization. Family income, parents' education, employment, health insurance, parental preventative practice, behaviors, and access to dental care are the factors that influence the utilization of DHS. Three factors that affect oral health care visits are dental anxiety, a preference for dental health protection, and a family dental health problem. According to Andersen's model, the child's age, the number of family members, education, the time required to access a dental service, and a positive parental attitude toward a child's oral health influence dental health service utilization. Most of the children needed dental health services, but they were underutilized. The majority of study participants underwent restoration treatment. Most schoolchildren had oral diseases such as dental caries, periodontal disease, and malocclusion. Programs that promote oral health and the availability of public hospitals are necessary to boost the use of dental services, improve parental and children's attitudes toward them, make them more accessible and affordable, and remove any remaining hurdles [26-28].

Over the past 50 years, there has been a marked improvement in clinical measures of oral health, partly due to the wide use of fluoridated toothpaste and a stronger focus on disease prevention in the dental health services of most Western countries. However, many studies have found rather weak associations between clinical and self-reported measures of oral health. Thus, when evaluating the oral health of a population, it is important to use both clinical and self-perceived measures. Dental caries is a costly and very common disease, especially in pregnant women. Reasons such as not paying attention to oral health, poor diet and also lack of adequate education in this regard cause this to happen. Performing well-designed educational interventions using primary health system's forces, can improve oral health of pregnant women and help control this disease [29-31].

Dental caries is the most prevalent global infectious diseases with considerable economic and quality-of-life burdens. There is enough evidence to conclude that poor oral health behaviors and bad dietary habits such as excessive consumption of sweets are important risk factors associated with dental caries. One of the groups most prone to tooth decay are pregnant women. According to reports, tooth decay in these people was up to 2.9 times more than normal people. They were also more likely to develop gingivitis and generally, their oral health was more at risk. Also, periodontitis is a common condition in pregnancy, and these two conditions are related to each other due to various factors. Periodontitis during this period can lead to negative pregnancy outcomes such as preterm birth and low birth weight. Maternal oral health status also can affect developing early childhood caries that may result in so many consequences for



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child's health in the future. The importance of oral health before, during and after pregnancy has attracted the attention of policymakers, scientific foundations, agencies, and Primary Health Care Providers (PHCPs) who serve pregnant women and young children. It is recommended that pregnant women receive oral health education and self-care behavior education to prevent dental infections during pregnancy period. A recent systematic review of oral health knowledge and awareness in pregnant women concluded that they had poor level of knowledge and awareness [32-33].

Many studies have reported risk factors for tooth loss. Oral health instruction is considered effective at improving oral health behavior and oral health. However, few studies have examined the relationship of dental clinic factors, such as the number of dental hygienists and implementation of oral health instructions, with tooth loss. Here, we conducted a multilevel analysis to clarify the dental clinic risk factors associated with tooth loss. Many studies have reported the risks of tooth loss. Since individual- and tooth-level factors are involved in tooth loss, some studies have conducted multilevel analyses to identify the risk of tooth loss. Tooth loss is associated with the type of dental visit and the risk of tooth loss was lower in those who had regular dental checkups compared with those who received treatment only. The number of people visiting dental clinics for dental checkups is increasing. Therefore, it is important to clarify the dental-clinic factors related to dental visits. For example, oral health instructions improve oral health behavior and oral health. However, few studies have examined the relationships of dental-clinic factors, such as the number of dental hygienists and the provision of oral health instructions, with tooth loss [34-35].

A growing body of evidence suggests that poor oral health of women during pregnancy negatively impacts health outcomes for both the mother and baby. Early childhood caries is a significant issue in Victoria, Australia, with almost half of all six-year-old children having a history of tooth decay. Poor oral health can negatively affect a child's speech, growth, learning, development, self-esteem, social and psychological wellbeing and influence the development of lifetime habits. Fortunately, oral disease is mostly preventable with appropriate oral hygiene knowledge, skills and practices. Pregnancy is an important time for women to care for their oral health because of the increased susceptibility to periodontal (gum) infection and the links between advanced gum disease and premature birth and low birth weight babies. In addition, poor maternal oral health may lead to adverse impacts upon the unborn child's oral health outcomes such as the transfer of maternal cariogenic bacterial flora to the child [36-37].

Prevention and early detection of oral disease in pregnancy can assist in managing a significant bacterial and inflammatory condition during pregnancy (periodontitis) and reduce the risk of infants developing early childhood caries. Educating pregnant women on the importance of dental care and good oral hygiene practices and the safety of receiving dental treatment during pregnancy is essential. Therefore, internationally research and oral health care and maternity care guidelines have begun to recognize the role of antenatal care providers in promoting the oral health of pregnant women [38-39].

Tooth decay is common amongst children, especially in areas of deprivation. From both a societal and health care perspective, tooth decay is a global problem with wide-ranging negative effects on children, their family and society. Tooth decay, however, is preventable, with appropriate oral health behaviors established in the home-setting in early-childhood providing lifelong protective effects. These evidence-based oral health behaviors for young children include twice daily parental supervised toothbrushing with fluoride toothpaste and limiting



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sugary foods and drinks. The term “optimal oral health habits” will be used throughout this paper to describe these oral health behaviors. Parents and local communities identify their preference for establishing optimal oral health habits from the outset rather than correcting poor habits at a later stage. To facilitate these optimal oral health habits, preventive programs need to be multi-faceted and provide consistent oral health messages across all professionals involved in early-years care. One key opportunity to provide oral health advice and guidance is when parents bring their child to the dentist [40-42].

Behavioral management techniques derived from pediatric dentistry practice (desensitization, positive-negative reinforcement, tell-show-do) have been used to improve the ability of children with ASDs to receive dental treatment and oral healthcare. This approach is the first attempt in a series of approaches to overcome undesirable behaviors during oral examinations and dental procedures. Behavioral management can be effective for some, but not for every patient. Many children with ASDs still require advanced behavioral guidance techniques, such as protective stabilization, oral sedation, and general anesthesia, to provide dental care. Behavioral approaches are the most common treatment approaches for children with ASDs, and interventions often include the use of visual pedagogy. It is defined as the ability to recognize and understand ideas conveyed through visible actions or images, and it can be used to enable and/or increase specific skills of children. The method involves the use of pictures/imagines either printed on paper or administered through digital tools, such as computers, smartphones, and tablets; such feasible interactive aids are becoming more and more utilized with special needs children. Among the different visual tools available, the Picture Exchange Communication System (PECS) is a frequently used augmentative communication system, in which picture cards are used to teach functional communication to non-verbal or limited speech children. Visual pedagogy protocols foresee the use of sketches and/or videos to repetitively teach children how to perform tooth brushing and which steps they will encounter during oral examinations and preventive and/or restorative treatments. The core of visual pedagogy is that children with ASDs become familiar with the storytelling that they will remember when in the dental office. A high number of studies have already been carried out on this approach, proving this to be effective in reducing anxiety and increasing compliance [43-45].

Various sources of oral hygiene knowledge, including television, schools, and dental clinics, have been reported to be associated with oral hygiene behavior. We previously conducted a cross-sectional study to investigate the associations between oral hygiene knowledge, the source of that knowledge, and oral hygiene behavior in a group of new university students. The results suggested that having better oral hygiene knowledge, as well as having dental clinics as the most common source of oral hygiene knowledge, were associated with better oral hygiene behavior. Thus, when university students have oral hygiene knowledge from dental clinics, they may improve oral hygiene behavior [46-47].

Dental treatment during pregnancy has been recommended by systematic reviews and several institutions, with guidelines on oral health care during pregnancy being widely available. Such recommendations are important to assure women’s well-being during their lifetime and to control the changes that occur in their oral health during pregnancy, since this condition can increase the prevalence of oral diseases. It is also relevant to determine the relationship between pregnant women’s oral health and negative outcomes that can occur during and after delivery. Moreover, pregnancy is considered an ideal time to establish educational and preventive



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programs, as pregnant women are more receptive to information about themselves and their babies' wellbeing and to adopt better health practices [48-49].

Effective oral hygiene measures carried out on a regular basis are vital to maintain good oral health. One-to-one oral hygiene advice (OHA) within the dental setting is often provided as a means to motivate individuals and to help achieve improved levels of oral health. However, it is unclear if one-to-one OHA in a dental setting is effective in improving oral health and what method(s) might be most effective and efficient [50-51].

The well-being of the oral cavity is an integral part of the general state of health of the individual: unfortunately, the increase in world population, and its general aging, has led to an increase in untreated oral diseases. Periodontal disease and dental caries are the most widely diffused pathology worldwide: it has been recognized that dental hygiene-therapists could play a role in the diagnosis of these two pathologies, and that their role could be implemented, for example, in public health services, as a support for patients during their hospitalization. The little concern that does exist in the literature for the oral health of hospitalized patients is limited to intensive care unit wards; attention must be paid to the risk of periodontal disease in patients admitted to this ward, as well as to patients in need of mechanical ventilation, where different bacterial colonization develops. Oral care can prevent plaque build-up, and, consequently, reduce the risk of hospital infections related to a low priority of oral hygiene and/or fear of feeling pain; it is important to note that oral care does not bring any benefits, and hospital staff are often poorly trained. Some studies, to prevent possible bacterial outbreaks, have found a good efficacy of solutions containing 0.12% chlorhexidine, accompanied by a good brushing of the teeth and washing with iodine solutions; in this sense, the nursing staff plays an important role in the maintenance of oral health, and, for this reason, it is beneficial if staffs are effectively instructed by professionals, such as dental hygienists. Furthermore, taking into account the fact that the accumulation of biofilms promotes the development of gingival inflammation, caries, and periodontal disease, and that these worsen during long periods of hospitalization, motivation and education plans should be developed for hospital staff, patients, and caregivers. The oral cavity is a reservoir for pathogens, and accurate oral hygiene, preceded by the screening and removal of potential bacterial foci, can help in managing infections in hospitalized patients. These are patients who can hardly take care of themselves, and therefore trust others for hygienic care, such as oral hygiene maintenance: dental hygienists could be the missing link to help the medical and nursing staff manage the health of these patients [52-53].

Adolescence is a critical period for health promotion. Evidence has shown that relatively stable patterns of health-related behaviors are established during adolescence and it is difficult to change these behaviors during adulthood. To improve oral health, it is necessary to focus on adolescents, as proper personal oral hygiene and eating habits are developed during this stage of life. Evidence indicates that adolescents with favorable oral health habits have better oral health as an adult than those with poorer oral health habits. Consequently, targeting adolescents when promoting oral health can be beneficial.

For school-aged children, school-based settings are more common and effective at providing preventive care than a community-based approach. School-based oral health education (OHE) has been applied successfully in some developing countries to achieve better oral health behavior and dental hygiene status of adolescents at a low cost [54-55].



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Multiple medical treatments, associated with the great variability of commercially available drugs, the continuous evolution of scientific research, the advent of procedures for the treatment of pain, modern drugs for the management of thromboembolic risk, and antibiotic resistance, are elements which it is necessary to respond to with absolute knowledge, training, and basic preparation, to meet the rehabilitation needs in the dental field. For this reason, it is important to provide the clinician, in daily clinical practice, with theoretical and practical support to manage the most common framework of systemic pathology of dental interest, including emergencies, as well as knowledge of prescriptions and the behavior of the most common drugs [56-57].

Poorly controlled diabetes affects periodontal outcomes and periodontitis also adversely affects blood glucose levels and worsens diabetes complications. The biological mechanism that links diabetes and periodontitis involves a complex interaction and that includes aspects of inflammation, immune functioning, neutrophil activity, and cytokine biology. The evidence supports that uncontrolled diabetes causes to elevate levels of several pro-inflammatory mediators and cytokines in saliva and gingival crevicular fluid (GCF), oxidative stress in periodontal tissues and formation of Advanced Glycation Endproducts (AGE). Furthermore, the interaction of AGE– Receptor for Advanced Glycation Endproducts (RAGE) exaggerates inflammatory response (inflammatory dysfunction, cellular stress and other changes to important periodontal cells) and leads to periodontal tissue destruction. Although evidence supports for a negative impact of periodontitis on diabetes control and outcomes, there is lack of mechanistic studies to explain its biological plausibility. However, potential factors include the mediators derived from periodontal disease (Interleukin (IL)-6 tumour necrosis factor (TNF)- α , and C-reactive protein (CRP) as well as oxygen radical) which impair insulin signalling and resistance [58-59].

There is also evidence that treatment of periodontal disease has beneficial effects on glycemic control, with a reduction of glycated hemoglobin (HbA1c), although this evidence is often considered of low quality due to the heterogeneity of the studies and small sample size. Recognizing the bidirectional link between diabetes and periodontal disease, as well as potential benefits of periodontal treatment, current guidelines recommend that patients with diabetes optimize oral hygiene behaviors and seek regular oral health check-ups to prevent periodontal disease and maintain good oral health status. Similarly, research indicates that improving oral health knowledge is essential for improving self-oral care practices [60-61].

The need for correct oral hygiene in pregnant patients is essential during the first trimester to prevent possible oral complications; the use of an electric toothbrush can reduce the Plaque Index and prevent strong gingivitis. Patients must be treated without stress, kept in a sitting position, and allowed to often change their position. In addition, pregnant patients often experience nausea and vomiting, as well as gastroesophageal reflux; therefore, it is good to motivate patients by providing instructions on both food and the use of fluoride toothpastes, to prevent the risk of caries. Subjects with coagulation disorders require medical advice before undergoing dental interventions that could cause bleeding. Hemophilic patients should be given clotting factors before, during, and after a dental extraction, or conservative dentistry that requires local anesthesia (for example, fillings); therefore, correct oral hygiene could help in avoiding dental procedures. Oncological patients should start dental treatments before the beginning of cancer therapy; professional oral hygiene, the extraction of compromised teeth, and restorations of teeth with wide caries are recommended. At bedtime, it is advisable to use



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an electric toothbrush and floss. In diabetic patients, evaluation of their periodontal state is needed, and it is influenced by high serum levels of HbA1c. In addition, hyperglycemia causes a thickening of the basal membrane of the capillaries, resulting in a worsening of permeability and perfusion to tissues, oxygenation, and elimination of metabolites from periodontal tissues. These patients may also have xerostomia, acetonemic halitosis, or hyperplastic gingivitis. Periodontal disease is more aggressive and faster in cardiopathic subjects; moreover, maintaining a balanced oral microbiome is particularly recommended, as it can reduce the complications of cardiovascular diseases. In fact, in the presence of valvular heart diseases and valvular implants, there is a greater risk of endocarditis from the migration of oral bacteria [62-63].

Oral diseases directly impact the lives of individuals by causing considerable pain and suffering, altering food choices, affecting speech, self-esteem, quality of life, and participation in everyday activities. Measuring the impact of oral diseases has traditionally been based upon the biomedical model that provides only limited insight into the impact of oral disease on people's lives. The emerging patient-centered care model⁴ necessitates a focus on oral health rather than oral disease. Although measures of oral health and oral health-related quality of life have been developed, they have not been shown to be useful in all of the important domains of clinical practice, health services research, epidemiology and advocacy. This is reflected in recent definitions of oral health that now include physical, psychological, emotional and social domains, which are core to overall health and wellbeing. From the patient-centered care perspective, oral healthcare providers should thus consider not only disease processes, but also the environmental, social and personal factors, overall quality of life and participation in all major life areas, including making decisions about and control over their health and the use of health services [64-65].

The WHO Operational Framework for Primary Health Care provides definitions for both primary care and primary healthcare. Primary care being defined as 'a key process in the health system that supports first-contact, accessible, continued, comprehensive and coordinated patient-focused care;' and primary healthcare defined as 'whole-of-society approach to health that aims to maximise the level and distribution of health and well-being through three components: (A) primary care and essential public health functions as the core of integrated health services; (B) multisectoral policy and action; and (C) empowered people and communities.' (WHO and the UNICEF, p. XIII). The conceptual basis for this review is situated in primary healthcare as an approach to improving oral health outcomes and reducing the global burden of oral diseases [66-67].

An integration strategy may refer to any activity or intervention (or combination of activities) whose purpose is to, directly or indirectly, support the inclusion of oral health in primary care. These activities could include (but are not limited to) policies, guidelines, frameworks, funding mechanisms and insurance schemes, interprofessional training and education, interprofessional practice, common performance indicators and establishing local or international networks to support the integration agenda [68-69].

Health care is organized in different ways to address these disparities depending on the political and administrative systems in the region. Workforce skill and mix, provision of public health and primary care services, geographic remoteness and service models for indigenous populations, all have a substantial influence on the effectiveness and efficiency of the



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indigenous health care systems. For some time, an innovative program to train dental therapists has addressed the need to provide better primary dental care [70-71].

Proper oral health behavior such as tooth brushing, use of dental floss and receiving regular dental checkups prevents periodontal disease. Furthermore, oral health behavior is also associated with various factors including dental knowledge, attitude, lifestyle, stress, education level, socioeconomic status, sense of coherence and self-efficacy. Among these factors, we focused on dental knowledge in a previous study and found that university students with dental knowledge practiced better oral health behavior such as use of dental floss.

Diagnosis refers to the identification of a disease based on the presentation of signs and symptoms. Health care professionals in all fields use diagnosis as a means to identify and discuss diseases with patients and formulate a plan for treatment. Dental hygienists incorporate diagnosis, specifically called dental hygiene diagnosis (DHDx), into clinical practice to assist in the prevention and treatment of oral diseases [72-73].

The demographic transition towards ageing societies and the related health burden have triggered a global focus on ageing and health and a fundamental shift in how we think about ageing, bringing forward the concepts of functional ability and participation in society. In oral health, an epidemiologic transition has further compounded the impact of the demographic transition, with profound implications for the burden of oral conditions on older populations. Oral diseases are one of the most prevalent health conditions globally, and their burden, especially tooth loss, is huge amongst the older population [74-75].

Oral diseases pose a significant public health challenge, especially among children and adolescents. Around 60–90% of school children worldwide suffered from caries and over 531 million children had caries of deciduous teeth. Moreover, most children and adolescents showed gingivitis symptoms. Approximately 2% of youth had aggressive periodontitis, which might lead to premature tooth loss. Oral diseases can negatively affect the quality of life, cause pain, limitation in oral functions, impaired nutrition, emotional stress, low self-esteem, and poor school attendance and performance. They also impose a considerable economic burden as oral health treatments are often expensive. The treatment cost of dental caries alone for children was estimated to surpass the total budget of healthcare for children in low-income countries [76-77].

One of the efforts to improve the oral health of children and adolescents is by implementing school-based oral health promotion programmes, as proposed by the World Health Organisation (WHO). Schools serve as ideal settings for health promotion as they can reach most school-aged children and provide important networks to their families and communities. School-based programs can also help increase children's access to dental services, especially those from disadvantaged socio-economic backgrounds. Moreover, school years cover the life period of childhood and adolescence, during which lifelong sustainable behaviors, beliefs, and attitudes related to health are established.

Several school-based oral health promotion programs have been proposed, such as oral health education (OHE), tooth-brushing activities, the provision of fissure sealant, or other treatments. While the effectiveness of the programs has been investigated, extensive evidence from a global viewpoint is still limited. Moreover, existing systematic reviews only focused on OHE. A study providing a complete picture of the effectiveness of different kinds of oral health programs at



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various school settings has not yet been available. This information is necessary to help the development of policies and the allocation of resources [78-79].

Despite the overall improvement of oral health shown by the age-standardized prevalence, the increase in the older population raises the number of people living with oral diseases. When evaluating the burden of oral disease in the older population, it is important to recognize the difference between crude prevalence and age-standardized prevalence. In many countries, the risk of tooth loss has decreased over the past decades due to improved socioeconomic conditions, lifestyle, and medical standards.

Oral health is considered a determinant indicator for the community's general health and wellbeing. Many factors can widely affect the oral health status of the population, among them include socioeconomic factors and health behaviors. The latter is mainly focused on preventive interventions and behaviors and is determined by the level of information and literacy of the community, particularly about the causal factors of dental caries and the effective modes of prevention [80-81].

Health information seeking behavior is considered as any action by individuals through which they want to increase their knowledge or information about a health issue in order to improve their health. People's attitudes and knowledge can incrementally affect their health seeking behaviors. According to Andersen's health behavior model, some individuals' health condition and their perceived consequence of the action or inaction can determine the health seeking behaviors.

Many interventions can be applied to improve the oral health seeking behaviors such as: developing the target population's education and awareness particularly on applying preventive strategies, implementing and developing health financing interventions and insurance packages and creating opportunities for increasing the access of the population for appropriate time and place of seeking oral health caries treatments [82-83].

Considering the relevant literature, online health services are among one of the ways to increase access and potentiality of seeking oral health behaviors. In this regard, emphasized that, although oral and dental health care professionals are defined as the main trusted and reliable sources for seeking information, other sources are commonly used by patients such as online health services. The degree of effectiveness and usefulness of such online information seeking is highly dependent on the health and internet literacy of the population in addition to access to information and communication technology (ICT).

Health seeking behaviors intend to improve ones' health, and in the process, that of the community. Developing online health resources, are necessary, in particular for youth and those in the most literate parts of the population such as the students. Although medical students are among those groups with an appropriate health literacy level and acceptable access to internet for information seeking, it is not clear whether they have a high level of health information seeking behavior or not particularly in a developing country [84-85]. To fill the present gaps and determine the status of online health seeking behavior in the area of oral and dental health, the present study is aimed to determine the attitude of Iranian medical students towards online oral health information seeking and the level of knowledge, attitudes and oral health practices in this area. The present results can inform policymakers to apply more appropriate and applicable plans and interventions to improve the oral health seeking behaviors among the community particularly in the developing contexts with the similar setting.



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Oral disease is common and affects overall health profoundly. Dental caries is the most prevalent chronic disease among children in the United States despite decades of public and private initiatives. Oral disease is complex with origins that are biological, psychological, and sociological. Experts agree that an improvement in oral health will come about only if it is addressed in an interprofessional collaborative manner that emphasizes medical-dental integration (MDI).

Oral health care disparities reflect unequal opportunities to be healthy, making disadvantaged groups even more disadvantaged with respect to their oral health; correspondingly, reducing oral health care disparities means giving disadvantaged social groups equal opportunities to be healthy. Pursuing equity in oral health care means pursuing the elimination of oral health care disparities, that is, equal access to available care for equal need, equal utilization for equal need, and equal quality of care for all. While the imperative to eliminate disparities in oral health has long been recognized, the vital role of access to quality oral health care for people who are low-income, uninsured, and/or members of racial/ethnic minority, immigrant, or rural populations has heretofore received insufficient attention in the public health literature. Disparities need to be more fully investigated in all aspects of oral health care, including the allocation of resources for oral health care, the actual receipt (utilization) of oral health care services, the quality of oral health care services, the oral health care workforce, and the financing of oral health care, particularly with respect to the burden of payment on individuals and households [86-87].

The Health Resources and Services Administration (HRSA) synthesized recommendations and considered expert and professional opinions expressed during the Integration of Oral Health Care and Primary Care Practice meetings. The following recommendations serve as guiding principles and provide a framework for the design of a competency-based, interprofessional practice model to integrate oral health and primary care: Apply oral health core clinical competencies within primary care practices to increase oral health care access for safety net populations in the United States. Develop infrastructure that is interoperable and accessible across clinical settings and enhances adoption of the oral health core clinical competencies. The defined, essential elements of the oral health core clinical competencies should be used to inform decision making and measure health outcomes. Modify payment policies to efficiently address the costs of implementing oral health competencies and provide incentives to health care systems and practitioners. Execute programs to develop and evaluate implementation strategies of the oral health core clinical competencies into primary care practice.

Oral health conditions during adolescence During puberty (preadolescence), which lasts from two to four years with an onset that varies by gender, race/ethnicity, and overweight/obesity, growth and maturation of the body and maturation of the brain accelerate, with accompanying emotional, cognitive, and behavioral opportunities and challenges. These physiological changes have a major impact on all areas and functions of the body, including the oral ecosystem.

Oral health conditions during adulthood and older age Over the past decade, an increasing number of children, especially disadvantaged children, have been visiting the dentist, and the gap in rates of oral health care between disadvantaged and advantaged children has been narrowing. In contrast, oral health care utilization for adults has declined during this time period, especially among the poor and uninsured, and in many states the gap in rates of oral health care between disadvantaged and advantaged adults has been widening. Compared with children and older adults, adults are much more likely to face financial barriers to all types of health care, and more people regardless of income, age, or source of dental benefits report



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financial barriers to dental care than to medical care, prescription drugs, eyeglasses, and mental health care. Since Medicare covers only narrowly defined medically necessary dental procedures and many state Medicaid programs do not cover dental services for adults, adults pay an increasing portion of their dental expenditures out of pocket as they age.

In dental hygienist education, for example, it is essential to provide opportunities for the students to reaffirm professional values and beliefs, including what kind of a dental hygienist they want to become, and to clarify their vision for the future in their education's early stage. In clinical education, dental hygienists and other professionals can assume specific roles within the community of practice through collaborative practice. To encourage group-level socialization, opportunities to meet role models who are active in various situations and internships in a community of practice can be used. It is also important to incorporate into the curriculum supportive methods that internalize the values of the dental hygienist during these social experiences. A multifactorial genetic effect in their etiology is more common in periodontal diseases. A further complication of the relationship between genes, environment and disease is that environmental genetic influences are necessary to maintain periodontal health.

The importance of introducing education and support that promotes professional identity formation in dental hygiene education has been internationally recognized. For example, service-learning exercises and curriculum revisions have been implemented to develop students' attitudes and sense of professional responsibility. However, the overall understanding of the process of dental hygienists' professional identity formation over time, beginning with their first year of study, remains unclear. Clarifying the process of dental hygienists' professional identity formation could provide insight into students' actual perceptions of the nature, tasks, and value system of the profession. Analyzing the discrepancy between their perceptions of the profession of dental hygienist and the learning outcomes expected by their teachers would provide a basis for improving and developing new educational strategies and learning support methods in the future. Therefore, in this study, as a preliminary investigation of dental hygienists' professional identity formation, we examined the changes in their perceptions of the dental hygienist profession during the three years of their undergraduate education.

In health care globally, there has been a focus on person-centered care, which is an individualized, holistic approach to care where the decision making is shared by the clinician and the client, and at times, includes the client's family or caregiver. Instead of viewing the client as a collection of symptoms, person-centered care fosters communication to take into consideration the client's values and goals. Dental hygienists have an ethical responsibility to provide opportunities for patients to make informed decisions about their treatment. Communicating the DHDx to the patients is part of that responsibility.

CONCLUSIONS

The importance of introducing education and support that promotes professional identity formation in dental hygiene education has been internationally recognized. For example, service-learning exercises and curriculum revisions have been implemented to develop students' attitudes and sense of professional responsibility. In addition, epigenetic changes in the environment also affect periodontal health. It is clear that many genetic traits (eg, type and quality of bone around the tooth root) and epigenetic changes in the oral cavity are important



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factors in determining the host's response to potential injury and conferring periodontal predisposition. The importance of personal oral hygiene for supragingival plaque removal is a central paradigm in periodontal management. Periodic patient extractions are important because dental bacterial biofilm is the most important modifiable risk factor for periodontitis. Therefore, there is strong evidence that mechanical removal of dental biofilm (eg, brushing, flossing) can significantly affect periodontal tissue stability. Good oral hygiene requires highly motivated and trained individuals with adequate manual dexterity, effective cleaning equipment, chemotherapy drugs to remove plaque, and proper oral hygiene instructions. In health care globally, there has been a focus on person-centered care, which is an individualized, holistic approach to care where the decision making is shared by the clinician and the client, and at times, includes the client's family or caregiver. Instead of viewing the client as a collection of symptoms, person-centered care fosters communication to take into consideration the client's values and goals. Dental hygienists have an ethical responsibility to provide opportunities for patients to make informed decisions about their treatment.

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**THE SCIENTIFIC TALKS OF MANIFESTATION OF PECULIARITIES OF
PHARMACIST PROFESSION, MODERN PROFESSIONAL CHALLENGES,
PHARMACEUTICAL SCIENCES, EDUCATION, PROSPECTS, INNOVATIONS
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ABSTRACT

The main goal of the study was to analyze the peculiarities of pharmacist profession, modern professional challenges, pharmaceutical sciences, education, prospects, innovations and society. The study was a quantitative investigation and analysis of features, characterizations, scope and capacities for pharmacist role in pharmacy, in clinic and in health care sector and pharmaceutical educational summons issues in the twenty-first century by using questionnaires. Were conducted a survey study. The in-depth interview method of the respondents was used in the study. The 7 types of approved questionnaires were used (Respondents were randomly selected): Questionnaire for chief pharmacists: 410 chief pharmacists participated in the study. Questionnaire for patients: 1506 patients participated in the study. Questionnaire for the employed pharmacy faculty-student: 222 employed pharmacy faculty students participated in the study. Questionnaire for health-care specialists: 307 public health specialists participated in the study. Questionnaire for pharmacist specialist, 810 pharmacist specialists participated in the study. Were used methods of systematic, sociological (surveying, questioning), comparative, mathematical-statistical, graphical analysis. The data were processed and analyzed with the SPSS program. Were conducted descriptive statistics and regression analyses to detect an association between variables. Statistical analysis was done in SPSS version 11.0. A Chi-square test was applied to estimate the statistical significance and differences. We defined $p < 0.05$ as significant for all analyses. According to the study results, being healthcare occupational means of to be a member of a group, which is centered on one purpose: serving with a patient to obtain better health. Pharmacist plays the centric role on the delivering of communication to patients and society about using of medicines. They effectively cooperate with doctor prescribers to assure a general treatment to patients by the delivery information and advice. The pharmacists are involved in a multidisciplinary treatment to the contribution the rational pharmacotherapy. They sufficiently informing patients and common society about the adverse influences of the drugs. They are monitoring these side effects via partnership together with different health care vocational. Pharmacists provide education on medications, disease states and the lifestyle issues as a part of clinical prevention, as well as educational programs to groups on issues such as drug abuse or others that are an example of population health activities. Pharmacists do counsel on a wide range of health promotion products found in the typical retail pharmacy such as sunscreens, dental hygiene products or vitamin and mineral products.

Keywords: Peculiarities, Pharmacist, Profession, Professional, Pharmaceutical Sciences, Education, Society.



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1. INTRODUCTION

Pharmaceutical care includes the process through which a pharmacist cooperates with a patient and other medical professional in planning, monitoring, controlling and implementing a therapeutic scheme that will generate concrete therapeutic results for to the patients. This set involves three major functions: identifying potential and actual drug associated issues; resolving actual drug associated problems; and preventing drug associated issues [1-3].

Pharmaceutical care is a needful element of health care system and should be integrated with other basic elements. It is provided for the straight benefit of the patient, and therefore the pharmacist is responsible entirely to the patient for the quality of pharmaceutical care [4-7].

The main relationship in pharmaceutical care is a jointly useful interchange in which the patient grants authority to the provider, and the provider gives competence, ability, capacity, power, capability, and commitment (accept responsibility) to the patient. The vital goals, processes, and relationships of pharmaceutical care exist regardless of practice setting [8-10].

Health care costs increase by annually, the volume of medication takes up a significant segment. Effective medication management and Patient care issues become actual. As a result, functioning of clinical pharmacist as a specialist in public health care system is required of human health protection in the private or public insurance companies' active participation will raise the demand for clinical pharmacist as a specialist in the area. Insurance companies work should be focused on the relationship between the clinic and pharmacy institutions with highly qualified specialists [11-13].

Goal: The main aim of the study was to analyze the scientific talks of manifestation of peculiarities of pharmacist profession, modern professional challenges, pharmaceutical sciences, education, prospects, innovations and society.

2. MATERIAL and METHODS

Research objectives are materials of sociological research: the study was quantitative investigation by using survey (Questionnaire). The study was quantitative investigation by using survey (Questionnaire). The in-depth interview method of the respondents was used in the study. The 7 types of approved questionnaires were used (Respondents were randomly selected): Questionnaire for chief pharmacists: 410 chief pharmacists participated in the study. Questionnaire for patients: 1506 patients (customers of drug-stores) participated in the study. Questionnaire for the employed pharmacy faculty-student: 222 employed pharmacy faculty students participated in the study. Questionnaire for health-care specialists: 307 public health specialists participated in the study. Questionnaire for pharmacist specialist, 810 pharmacist specialists participated in the study.; Totally 3888 respondents were interviewed in Georgia. We used methods of systematic, sociological (surveying, questioning), comparative, segmentation, mathematical-statistical, graphical analysis. The data was processed and analyzed with the SPSS program. Results and discussion: The survey was conducted through the questionnaires. 1506 patients were interviewed in Georgia. Questions and answers are given in the tables. On each question are attached diagrams or table. Questionnaire and diagrams are numbered. Study of the data was processed and analyzed with the SPSS program. We conducted descriptive statistics and regression analyses to detect an association between variables. Statistical analysis was done in SPSS version 11.0. A Chi-square test was applied to estimate the statistical significance and differences. We defined $p < 0.05$ as significant for all



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analyses. The study's ethical items. In order to provide the study's ethical character each participant of it was informed about the study's goal and suggested of willingness of the work to be done. So, the respondents' written or oral compliance was got on that issue. All the studies were carried out by the selected organizations administrations' previous compliance. Were used Informed consent form for each respondent to participate in an anonymous survey. During the whole period of research, the participants incognita was also provided. For the international rules and criteria' conformity this human subject comprising given study was discussed and confirmed on the Bioethics Committee sessions of the YSMU. In order to meet the objectives, set in the research we also used the results obtained through analysis of available official information, studies and opinions about pharmacists, as well as the methods of quantitative studies. We conducted descriptive statistics and regression analyses to detect an association between variables. Statistical analysis was done in SPSS version 11.0. A Chi-square test was applied to estimate the statistical significance and differences. The research implementation required the following sub studies: the scientific talks of manifestation of peculiarities of pharmacist profession, modern professional challenges, pharmaceutical sciences, education, prospects, innovations and society.

3. RESULTS and DISCUSSION

On the basis of performed study results the following have been found:

The health systems of many other countries have developed similar claims of competence for pharmacists. As a critical care pharmacy specialist, it is difficult to describe a typical day, but usually busy with the elements of a pharmacist's support process during the day. It is believed that the clinical pharmacist will be responsible for all aspects of the administration of the drug. Every day, the clinical pharmacist assesses and evaluates new patients and updates the progress of previous patients, identifies drug-related issues and potential problems, develops a problem list and treatment plan for optimal dosage based on the renal and hepatic function, potential drug interactions and serum concentration. The clinical pharmacist joins the multidisciplinary rounds with the intensive care team and applies the treatment plan by teaching the medical residents the correct order of entry or by entering the orders themselves according to a collaborative practice agreement and by them. documenting in an electronic health record. A major contribution to medication management is identifying therapies that are no longer needed, reducing the cost and risk of adverse events, and supporting antimicrobial stewardship programs with infectious disease physicians and pharmacists. The clinical pharmacist also supervises the performance of quality measures such as the appropriate prevention of venous thromboembolism, the appropriate use of drugs to prevent stress gastritis, the addition of aspirin to increase the levels of troponin associated with I coronary ischemia, and discussing the need for central tubing and urinary catheters. The clinical pharmacist educates the team on drug-related topics and related literature through tours and didactic discussions. A clinical pharmacist is always available for emergencies and resuscitation, and to answer questions related to medication [14-16].

The term "pharmaceutical care" was published in 1990. Many of European countries have tried to explain the meaning of this word. Given the fact that European countries are different pharmaceutical activities and policies of the organization, according to their different visions of the issue.

Pharmaceutical care is the responsible provision of pharmacotherapy for the goal of reaching certain effect that enhance a patient's quality of the life. That results are: treatment of a disease;



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elimination or decrease of the patient's symptomatology; exciting or slowing of a disease process; or preventing a disease or symptomatology [17-18].

Q-1. What are the issues to which for pharmacists are in need of additional- further regular study or training? (You can indicate several answers)

On the question-What are the issues to which for pharmacists are in need of additional- further regular study or training? (You can indicate several answers) Health-care specialists' 60.9% answer New medications, Health-care specialists' 33.6% answer psychology of communication with customers- consumers (patient), health-care specialists' 64.2% answer issues of pharmacotherapy of certain diseases, health-care specialists' 50.2% answer safety and effectiveness of drugs (medications), health-care specialists' 73% answer pharmacology and pharmacotherapy , health-care specialists' 30.6% answer normative legal regulation of pharmaceutical activity ,health-care specialists' 53.4% answer about drugs (medications) toxicity, health-care specialists' 36.5% answer about drugs (medications) dosage, health care specialists' 35.8% answer about routes of drug administration , health care specialists' 19.9% answer about drug forms , health care specialists' 14% answer about drug design, health care specialists' 40.1% answer about rules of drug administration , health care specialists' 18.6% answer about drugs generic, chemical and brand names, health care specialists' 35.2% answer about selection of (Over-the-counter) OTC drugs, health care specialists' 31.3% answer about cost-effectiveness and cost-benefits of drugs.

Community pharmacists' activity is at the forefront of medical care, working at their own pharmacies or in the private ones. Pharmacist's job is all about helping the public, as they participate in the medicines distribution and offering advice to patients and maintaining their health. Pharmacist work is a very demanding occupation in the world. Pharmacists usually are greatly honorable members of the society. Changes in the role of pharmacist and pharmacy community as a medical supplier accelerate along with the fast-moving environment. Today to offer advanced medical services pharmacies deliver educational information at multiple points of contacts and also to raise awareness of the disease are of great importance. These include over the counter (OTC) and the personal care aisle, a pharmacy counter, specialties publications and pickup areas prescription. These innovations are useful not only for customers' pharmacies but also create opportunities for pharmaceutical marketers, measurable return on investment. The educative center of occupational programs and schemes growingly identifies the necessity for the possibility to use the knowledge obtained via simulation laboratories or experiential studying, which needs corresponding faculties and personnel conditions to satisfy these educational necessities. Innovations in faculties and personnel positions with greater consideration to learning, or practice also include accentuation on the research within the framework of PharmD programs. There is a need to encourage the pharmacy's graduates to encounter that, as well as to conducting PharmD degree programs in postgraduate level masters or doctoral scale in philosophy or promoted scientific basement grants for the pharmaceutical, biomedical, clinical, administrative and other fields of researches in the pharmacy direction [19-20]. In the higher pharmaceutical institutions and academy, the health occupations schooling-education programs should contribute career possibilities for pharmacy faculty post-graduates. Pharmacy schoolmaster must make more energetically engaged at the growth for particular training /educational possibilities to arrange and overlook the newest generation for pharmacy faculty or program personnel positions in higher education institutions. In order to engage pharmacy faculty post-graduates to take part in the scientific research. Pharmaceutical



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faculty program post-graduate professionals should be supported to research the capacity function and role of various pharmaceutical, medical/health care, academic and educational, research and scientific program schemes for to growth consideration in inter-professional scientific groups upon the health professions formation, teaching and education; which is very significant for the high-quality patient care services [21-22].

Clinical pharmacy and career opportunities, although many clinics across the country participate in international clinical trials, which according to international protocol should have a clinical pharmacist participate, although at this stage such a profession and staff clinics turns out to be general practitioners formally fulfill the functions of a clinical pharmacist, which is confirmed in our survey that a pharmacist is needed to expand the role at Georgia. Clinical pharmacy as the field of pharmacy concerned with the science and practice of rational drug use. With this definition, the possibilities for clinical pharmacists are endless. Many career options are available to pharmacists seeking clinical opportunities in their practice. As a clinical pharmacist, you can provide general clinical services. However, there are several highly specialized areas that cover different patient groups [23-24].

Pharmaceutical supply will be an important new concept, representing the growth of the profession beyond clinical pharmacy as commonly practiced and beyond the other activities of pharmacists, including the preparation and dispensing of medicines. In Europe, however, all these professional activities are important and strongly support the need for pharmacists to be involved. In practice, these activities should be integrated and result in the pharmaceutical care of individual pharmacists for individual patients. The philosophy of pharmaceutical care (PA) is the sum of the pharmacist's responsibilities to meet all of the patient's medication-related needs through direct patient care and collaboration with other facets of the healthcare system. Clinical pharmacists have in-depth therapeutic knowledge and scientific skills that enable them to act as experts in drug therapy in healthcare settings.

Research activities to generate new knowledge and practical skills that can further improve health and quality of life. Over the years, the role of pharmacists has evolved to be part of a multidisciplinary healthcare team, participating in patient advisory groups and reviewing the patient profile with the aim of identifying and resolving drug-related problems. Pharmacist interventions such as B. Patient counselling to improve adherence and compliance, have contributed to the steady development of clinical pharmacy services around the world, the lack of specific legislation and recognition by other healthcare providers [25-26].

Possible reasons may include a lack of acceptance of the pharmacist's professional position by other healthcare professionals, poor leadership skills, patient perceptions, and the existence of communication gaps between pharmacists and physicians. These challenges are particularly noticeable in developing countries. Physician expectations and perceptions about the roles and responsibilities of pharmacists are the main factor influencing the advancement of clinical pharmaceutical services in hospitals [27-28].

Recent reforms to hospital implementation guidelines state that pharmacists should be assigned to hospitals for the benefit of patients. Prioritizing national guidelines, the undergraduate pharmacy curriculum shifted toward patient-centered practice by including a mandatory one-year internship program as part of academic training. Hospital clinical pharmacists began to work as an integral part of healthcare teams. Clinical pharmacists sporadically provided various care services to patients.



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This includes managing drug therapy, dose adjustments, interventions to optimize drug therapy, and providing information about drugs to healthcare professionals and patients. Hospital. A better understanding of the perspectives of healthcare professionals regarding clinical pharmaceutical services may provide a better opportunity to identify future challenges and opportunities for clinical pharmacists in the hospital. Therefore, the present qualitative study aimed to examine the challenges and opportunities of clinical pharmaceutical services provided in the hospital from the perspective of healthcare professionals [29-30].

On the basis of the theoretical and logical analysis the structure and composition of the factors have been developed, considering the objective (external), subjective (internal) and universal factors, which influence on the professional formation of the pharmacist. These factors comprised the content of work, position, correspondence of qualification and nature of work to capabilities, aspirations and inclinations of the pharmacist, the existence of perspective for professional promotion. The existence of perspectives for career promotion, the possibility to enhance qualifications, a high degree of responsibility for the work results, regimen, labor salary and the system of benefits scheme for employees, support and assistance of a manager, direct relations with manager and colleagues serve the essential base for the pharmacists' successful work. The unity of criteria for pharmacist professional formation, for the common professional formation (characteristic to all stages) and the specific professional formation (characteristic to the separate stage) had been developed. A pharmacist's involvement in the development and conduct of a clinical research study of an investigational drug is critical to maintaining the highest standards of drug safety and ultimately the quality, efficacy and safety of the study results. The pharmacist has the potential to act as a consultant in protocol development or review, to support protocol implementation in a facility, and to provide ongoing compliance or audit support. Ultimately, the pharmacist's experience and training in the safe and effective use of medicines translates naturally into the clinical research environment, enabling researchers to conduct clinical trials more safely and competently [31-32].

A clinical pharmacist is in no way a competitor of a doctor, on the contrary, he must refer patients who need qualified medical care to a doctor. It is difficult to imagine that a pharmacist does not know the alphabet of medicine and does not have relevant knowledge of the main clinical syndromes. Must have a particularly good knowledge of the nomenclature of medicines (mainly over-the-counter medicines). In essence, a clinical pharmacist must provide a defined pharmaceutical supply and make a decision about the dispensing of the drug [33-34].

It should be noted that in developed countries and in many developing countries pharmaceutical specialty is regulated profession alike the family medicine. In western countries pharmacist as a family doctor need higher pharmaceutical education, diploma and continuous pharmaceutical education, pharmaceutical license and periodic accreditation. Only pharmacists with higher pharmaceutical education have the right to work as pharmacists' position in the pharmacies. On the pharmacists' certification programs should be only involved pharmacists who have graduated pharmaceutical faculties from state recognized and accredited universities. It is necessary to provide a deep cooperation between pharmacists and physicians on the issues of pharmacotherapy and healthcare to ensure the patients' health state effective improvement, and also to provide the best feedback regulation and revision in the healthcare specialists' team work. Pharmacists also should be responsible for registration of the drugs' side effect, as well as be attentive in case of impropriety and professional defects of drugs they provide. To



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achieve that it is necessary to raise awareness of specialists on the essence of pharmacists' profession and functions among the medical personnel and general public [35-36].

The clinical pharmacist monitors and evaluates the prescribed pharmacy programs in terms of operational, quality and financial efficiency and regularly compares himself with the best local and national practices; The clinical pharmacist proactively identifies practice issues that need to be assessed and promotes clinical research projects, quality improvement initiatives, or the training of healthcare professionals as needed to advance the practice. Clinical pharmacist develops and oversees policies and procedures for drug procurement, drug use, drug distribution and drug control. The clinical pharmacist ensures that the pharmacy is an integral part of the health care delivery system and contributes to the improvement and expansion of pharmacy services/programs; Provides direct patient care and clinical practice, including decentralized and service-oriented programs; The clinical pharmacist is well versed in decentralized pharmacy services and clinical pharmacy programs; Works as an active member of a multidisciplinary team and collaborates with healthcare providers in decentralized patient care areas to provide patient-centered care; Identifies high-risk patients and implements measures to improve quality and safety; Makes appropriate, evidence-based, patient-centered drug recommendations; The clinical pharmacist is involved in the management of emergency medical care; Providing a review of medication intake at discharge, approval and counseling as needed; Provides pharmaceutical services throughout the medical center; Owns hospital IT systems and drug ordering systems; Provides accurate, safe, timely and appropriate drug therapy in accordance with the age and needs of the patient; The clinical pharmacist performs critical patient monitoring and reviews the patient profile / chart to identify, prevent, or mitigate drug-related problems, wrong drug or dose selection, sub-therapeutic dose, overdose, drug adverse reactions, drug interactions, drug missing, no indication to treatment, the use of drugs without indications and treatment failure; The clinical pharmacist communicates effectively and appropriately with healthcare providers and caregivers (doctors, nurses, etc.), and ensures the continuity of pharmaceutical care between shifts and between staff; The clinical pharmacist is actively involved in drug management and restriction programs; Participate in the work of pharmacies and distribution of medicines; Clinical Pharmacist maintains competence and actively participates in operations programs, central pharmacies, subsidiary pharmacies and specialty pharmacy areas, as required by the work assignment; Facilitates the process of purchasing, ordering and dispensing specialized drugs, including but not limited to chemotherapy, parenteral nutrition, controlled substances, etc., as appropriate [37-39].

Standard safety practices for investigational drugs in clinical trial protocols are limited and the vast majority of research pharmacists have safety concerns. Identified drug safety risk areas include protocol complexity, drug ordering, and processes involved in packaging, storage and distribution of investigational medicinal products. Pharmacist involvement creates several mechanisms to improve the safety and quality of clinical research. This is accomplished by participating in the development of the study protocol, reviewing as a member of the advisory committee, developing mechanisms to promote safety, and ensuring compliance with local and national regulations and standards. Ultimately, the pharmaceutical profession has a fundamental responsibility to ensure the safe and effective use of drugs, including investigational drugs, in clinical trials. Through interdisciplinary collaboration, the research study achieves the highest safety standards and maximizes the quality and efficiency of the data obtained during the clinical study [40-41].



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Responsible administering of drugs involves that healthcare network mediator capabilities and activities are balanced to assure that patients get the right drug, on the proper time, using properly and patient have profited from them. Delivering the right drugs into patients' demands commitment of all representatives, inclusive Government and a desire on how to consolidate private and public interests and mobilize sources. That is significant for the public to be guaranteed that expenses on pharmaceuticals productions are an equivalent cost of cash. On the viewpoint of the pharmacists' comprehensive academically field and their traditionary function in composing, qualifying, delivering and ensuring drugs. A pharmacist is informing customers, consumers and patients on the drug using; they are greatly positioned to suppose professional liability for the monitoring of pharmacotherapy. They are members of the healthcare team immediately engaged in patients' health care services. Their responsibility is to assistance patients in using their drugs, which is impossible to do alone. Thus, in terms pharmacists' profession have been progressed. New type pharmacists have done the work a in more efficient way. Pharmacists holding the higher, university-level education. They understand the biochemical mechanisms of metabolism, mechanisms actions of drugs, medicines pharmacotherapeutic characteristic, side effects of drugs, potential interactions of drug and the argumentations monitoring. It is conjugated of specialized knowledge of biochemistry, anatomy, therapy, physiology, pathology, pharmacology and other pharmacy subjects. The pharmacists explain this particularized knowing when communicating with physicians, patients and another health care providers [42-43].

Being healthcare occupational means of to be a member of a group, which is centered on one purpose: serving with a patient to obtain better health. Pharmacist plays the centric role on the delivering of communication to patients and society about using of medicines. They effectively cooperate with doctor prescribers to assure a general treatment to patients by the delivery information and advice. The pharmacists are involved in a multidisciplinary treatment to the contribution the rational pharmacotherapy. They sufficiently informing patients and common society about the adverse influences of the drugs. They are monitoring these side effects via partnership together with different health care vocational. Pharmacists provide education on medications, disease states and the lifestyle issues as a part of clinical prevention, as well as educational programs to groups on issues such as drug abuse or others that are an example of population health activities. Pharmacists do counsel on a wide range of health promotion products found in the typical retail pharmacy such as sunscreens, dental hygiene products or vitamin and mineral products. Moreover, pharmacists provide immunization services and participate in screening activities [44-45].

Though the quantity of pharmaceutical productions on the world market is growing, the approach of vital medicines is till now lacking in a lot of parts of the worldwide. Health care expenses rise and the technological, social, political and economic conditions change have made the health care transformation crucial across the worldwide. The renewed treatments are required reforms at the personal and public levels to ensure effectively, quality and safe pharmacotherapy to the patients in more ever complicated surroundings condition [46-47].

The pharmacists hold the great condition to satisfy the necessity for health care vocational to ensure effective and safe using of medicines. To do this, pharmacists should suppose higher liability than they at the present time do for the monitoring of pharmacotherapy for the customers, consumers and patients they are serving. That liability goes completely behind the traditional distributing and dispensing practices that have long been the maintenance of



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pharmacy activities. Pharmacists' liability should be enlarged conclude controlling of the pharmacotherapeutic progression and thereby improve therapeutic outcomes and patients' life quality, advising with doctor prescribers and consolidating with different health care workers and practitioners on behalf of patients [30]. Pharmacists' involvement into pharmaceuticals may consist in drug storage, drug supply, dispensing, manufacturing, formulation, distribution, marketing, quality warranty, licensing, information management, monitoring, development, education, and research. Drug supply and medicine information management system is the main part of pharmaceutical services and proceeds forming the basement of pharmacy activities. The higher pharmaceutical schooling and education hold an appropriate duty and responsibility to generate post-graduate professionals who are qualified and authorized to provide the pharmaceutical care services. Sufficiency results promote to quality warranty by provided that easily approachable working standards [48-49].

A large majority of respondents' (pharmacists) consider that the Government should make the certification of pharmacists. As revealed, it is very important that the occupation of pharmacist should become regulated health profession. To raise pharmacists' specialists' professionalism, Government should make the certification of higher pharmaceutical education pharmacists. That is very essential for pharmacist's professional perfection, for successful higher pharmaceutical education, for pharmacist self-realization, for pharmacist's career advancement, for to exist pharmaceutical continuous professional education, for pharmacist professional growth, for pharmacist job gratification, for pharmacist career satisfaction, for pharmacists much higher status between health care specialists. Pharmacist certification is essential for pharmacists economic (material) welfare , for allows pharmacists to realize fully the received knowledge from higher education institution in work by the full extent, for to have private pharmaceutical activity, for pharmacists vocational development , for correspondence of pharmacist qualification to work, for further improvement perspective for pharmacists' professional promotion, for possibility to career enhancement strategy, for to realize by the full extent pharmacist professional capabilities, skills and habits, for occupational growth, for pharmacists professional satisfaction, for career enhancement perspective, for satisfaction of income (salary). Therefore, pharmacists' certification should start immediately and pharmacist vocation should become regulated health profession like family doctors.

The majority of the respondents (chief pharmacists) considered that main qualities, capabilities and skills required for pharmacists were ability to make decision fast and love towards their profession.

Less than half part of chief pharmacists considered that main qualities, capabilities and skills required for pharmacists were flexibility while changing the labor functions, ability to build up relations with people and high level of culture.

Therefore, the role of pharmacist is underlined in healthcare system. For the higher quality healthcare and pharmaceutical services education level is of great matter. The study provided showed that the health of patients was directly related to the professional education level of pharmacist. Therefore, pharmacist should have appropriate higher pharmaceutical education, higher professional knowledge in pharmacology, pharmaceutical care, pharmacotherapy, clinical pharmacy and other professional subjects.

For the majority of respondents' patients mostly asked the pharmacists about the rules of drugs intake and prices of drugs. For the less than half part of the respondents mostly asked about the



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drugs' adverse effects and quality. For about the one third of them mostly asked about help in selection of analogue of drugs, indication/contraindication of drugs, the terms and conditions of their storage (conditions and shelf-life), the drugs dosage, rules of drug administration and selection of OTC drugs.

Therefore, pharmacist should possess deep and steady knowledge in pharmacology, pharmacotherapy, toxicology, pharmaceutical care, clinical pharmacy, pharmacokinetics, pharmacodynamics, basics of medicine and other pre-clinical and clinical subjects. Such knowledge can be obtained only from higher pharmaceutical education institutions. Therefore, pharmacist working on pharmacist position must have exclusively the higher pharmaceutical education.

The respondents' -public health specialists' majority considered that the pharmacists' functions in a pharmacy consisted in realization of drugs and instruments of medical purpose and providing information about drugs to the population. Less than half part of the respondents considered it to be in ultimate care about the patients' health and wellness, the drugs dosage and dispensing. About one third part of the public health specialists considered it to be in creation, development, production and sale of drugs, medical devices, instruments for medical purposes and healthcare products. About one third of the health specialists considered the pharmacists to be experts of drugs; about one third of them – to be inform of customers in cost-effectiveness and cost-benefits of drugs, the rest part of them considered that pharmacists help in selection of analogue of drugs. According to that pharmacist job should become regulated and more authorized in health care system.

The respondents' public health specialists' majority considered that the pharmacists' functions in a pharmacy consisted in realization of drugs and instruments of medical purpose and providing information about drugs to the population. Less than half part of the respondents considered it to be in ultimate care about the patients' health and wellness, the drugs dosage and dispensing. About one third part of the public health specialists considered it to be in creation, development, production and sale of drugs, medical devices, instruments for medical purposes and healthcare products. About one third of the health specialists considered the pharmacists to be experts of drugs; about one third of them – to be inform of customers in cost-effectiveness and cost-benefits of drugs, the rest part of them considered that pharmacists help in selection of analogue of drugs. According to that pharmacist job should become regulated and more authorized in health care system.

The respondents' public health specialists' majority considered that importance in work of pharmacist was in personal realization as a specialist, receiving remuneration and provision of necessities of life. The respondents' minority considered it to be in relief of pain in suffering of people.

Less than half part of the respondents' public health specialists considered that the level of basic training of pharmacists was not corresponding to the contemporary requirements. According to the sociological study results of the public care specialists it is obviously, that all pharmacists should have higher pharmaceutical education from the state recognized and accredited higher education institutions and universities. Pharmacists' specialty should become a regulated health care profession. According to that Government should make certification, licensing and accreditation of pharmacist professionals.



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The respondents' public health specialists' vast majority considered that the issues to for pharmacists were in need of the further regular studies or trainings in the following fields: new medications, issues of pharmacotherapy of certain diseases, pharmacology and pharmacotherapy, drugs toxicity. From the study results it is obvious that in the higher pharmaceutical institutions' pharmaceutical educational programs and curriculum need upgrade, renewal, modernization and adaptation to the new modern medical challenges. Therefore, continuous pharmaceutical educational programs should be created. These programs should be more focused on new medications, pharmacotherapy, drugs toxicity and dosage, routes of drug administration, selection of OTC drugs, cost-effectiveness and cost-benefits of drugs.

Approximately half part of the respondents' public health specialists was not familiar to the concept of pharmaceutical care; while more than a quarter of the public health specialists were well familiar to the concept of pharmaceutical care.

The respondents' public health specialists' large majority considered necessity of provision of cooperation between pharmacists and physicians on the issues of pharmacotherapy. The pharmacist must provide information to doctor about new drugs pharmacotherapy, the generic replacement drugs, the cost-effectiveness and cost-benefits of drugs, drugs' generic, chemical and brand names. In our opinion and vision cooperation between pharmacists and physicians on the issues of pharmacotherapy is positively reflected on patients' health and has great importance for provision higher quality health care service for patients' safety.

More than half part of the respondents' public health specialists considered that pharmacist is not in charge of treatment as a physician, meanwhile about a quarter of the public health specialists considered a pharmacist to be in charge of that. Properly educated pharmacist can minimize and reduce the mistakes made by a doctor in the recipe. That has a great importance and value for provision higher quality health care service for patients' safety.

The respondents' public health specialists' vast majority considered that pharmacist should provide assistance in teaching patients to understand the prescribed drugs intake rules. According to that higher quality pharmaceutical service could be only provided by the pharmacists of higher pharmaceutical education, graduated from the authorized, accredited and licensed by the state higher education institutes and universities.

To provide contribution and assistance in teaching of patients to understand the prescribed drugs intake rules, pharmacists need in deep knowledge in basics of medicine, pharmacology, pharmacotherapy, pharmaceutical chemistry, pharmaceutical care, clinical pharmacy and other pharmaceutical disciplines. Properly educated pharmacists have great importance and value for the provision higher quality health care services, for the provision higher quality pharmaceutical care and very essential for patient's safety.

About half part of the respondents' public health specialists considered that pharmacist is not responsible for registration of adverse effects of the drugs, while less than a third part of them considered pharmacist to be responsible for that. By legislation one of the functions of pharmacist is to register the side effects of drugs, what is very essential for patients' safety. It should increase the awareness of pharmacist as the health professional.

The respondents' public health specialists' vast majority considered that the Government should make the certification of pharmacists. It is very essential and important that higher



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pharmaceutical educated pharmacists to have pharmacist license issued by the Government. The vast majority of the public health specialists considered that the professional activity of pharmacist is very important for the society.

For the majority of respondents mostly significant factors while choosing a pharmacy were: service culture, wide range of products and reasonable prices. For less than half part of respondents mostly significant factors while choosing a pharmacy were: possibility to receive consultation about medications with a physician/ a pharmacist, convenient location of the pharmacy, high qualification of pharmacist personnel.

During research the factors, influencing on the pharmacy faculty students' professional development were found and evaluated. These factors included interesting and valuable work, the favorable psychological climate within the colleagues' team, possibility of career development, professional training, social importance of profession and independence in the work.

The employed pharmacy faculty students' vast majority considered that the Government should make the certification of pharmacists to raise professional standards licensing and certification of pharmacists. The certification of higher pharmaceutical education pharmacists is very essential for the pharmacist's professional perfection, for pharmacists' career enhancement, for vocational advancement and it is main determine detector factor for pharmacist professionalism level. Pharmacist position should become regulated health profession as the member of other health profession team (but now unfortunately pharmacists are not member of regulated health teams). Pharmacists' periodic licensing, certification and accreditation should increase pharmacists' professionalism level and is guarantee upper quality pharmaceutical care. All above mentioned is indicator factor of the health care system service quality.

First time were complex studied professional peculiarities of the pharmacists per vision by pharmacists specialists, professional peculiarities of the employed pharmacist-student, professional peculiarities of the pharmacists by vision of the chief -pharmacist, peculiarities of professional for pharmacists via per vision of the health-care specialist, pharmacists' professional features as per view of the patients, professional peculiarities of the young pharmacist- specialists, professional peculiarities of the pharmacist-student. To reveals influencing factors for the specificities of the role, achievements, innovations, professional and enhancement prospects of pharmacists in health care sector. In result of the study and evaluation of the pharmacist's professional peculiarities news, objectively reasoned comprehension of the problems in this field has been adopted, which became a base for developing recommendations. In particular, for the first time the following have been studied and established: the peculiarities of professional and career improvement strategy for pharmacists, pharmacist specialist's professional features, specificities of the role, achievements, innovations, professional and enhancement prospects of pharmacists in health care sector globally. First time the process of professional formation of pharmacists in the scope and context of pharmaceutical care, including the stages of professional development was studied and scientifically established. First time the most influence factors for the pharmacist's professional formation were identified. Deepen defined the role of pharmacist and the specific features for the pharmaceutical specialists' formation at various stages were studied and identified. On the bases of comprehensive studied was revealed, that pharmacist specialists in contradistinction to other medical specialists like physicians, dentists etc do not have continuous education,



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periodic certification and licensing. Pharmacists' profession removed from the regulated and certified health professional members' team.

The results of our study have been shown and substantiated, that the pharmacists, as well as doctors and stomatologists, who are obliged to take part in the mandatory certification by the Government, in order to improve the responsibility on their own professional specialization for motivate and improve their vocational knowledge and skills with the help of continuous education.

It would be promoted, that pharmacist to become more responsible, accountable and liable on for enhance their professional knowledge, skills and competencies. All the above mentioned first time we conducted a comprehensive and deep study of the scientific research for specificities of the role, achievements, innovations, professional and enhancement prospects of pharmacists in health care sector globally.

A little less than a fifth of higher pharmaceutical education pharmacists have realized professional capabilities, skills and habits to the full extent, A little bit less than half of higher pharmaceutical education pharmacists have realized professional capabilities, skills and habits partially, more than 50% of own potential, about a quarter of higher pharmaceutical education pharmacists have realized professional capabilities, skills and habits - partially, less than 50% of own potential . At the same time the vast majority of the pharmacists and health care specialists noted that pharmacists' knowledge in disciplines, such as the pharmacology, pharmacotherapy, pharmaceutical care and clinical pharmacy were a lack of insufficient for the successful work. Health care specialists' vast majority think that pharmacists are in need of additional- further regular study in the above-mentioned directions. Approximately half of the respondents considered that just 50% of their own potential was realized at the work position. Anyway, the overwhelming majority of the young pharmacists would not like to leave their profession. The vast majority of young pharmacist specialists consider that in pharmacology, in pharmacotherapy, in pharmaceutical care, in clinical pharmacy their knowledge is a lack or is not enough for successful work [27-29].

The vast majority of the pharmacists (84.4%) considered that for full pharmaceutical activity it is necessary to provide continuous professional education; therefore, higher pharmaceutical education pharmacists consider that professional education should not be ceased. The vast majority of pharmacy faculty students consider that education should not be ceased. Pharmacy faculty students' more than a third was working by specialty. The huge part of the pharmacists (55.6%) considers the continuous professional education is essential for the career growth and professional development, which enables getting information of new drugs and updated knowledge of some diseases' pharmacotherapy, pharmacology and the pharmaceutical care. At the same time, the minority of respondent pharmacists (8%) had not used knowledge obtained from the professional publications and literature in their practice, while less than half of them (41%) had partially used. Competent pharmacist specialist who is capable of providing qualified pharmaceutical care (assistance) is formed in the professional training process.

A large majority of chief pharmacists (76.6%), vast majority of patients (82.6%), of the vast majority of the employed pharmacy students (95.9%), the large majority of the healthcare specialists (94.8%) and a big majority of pharmacists (71.9%) considered that the Government should imply the pharmacists' certification in the way acting for other medical specialists. That



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is very essential for pharmacists' professional perfection, for self-realization, for career advancement, for continuous professional education, for professional growth.

The necessity of pharmacists' certification was stated more often by employed students than by pharmacists (Chi-square = 57.3, $p < 0.001$). Statistically significant was association between patients' educational level and their opinion about the necessity of pharmacists' certification ($p < 0.04$): patients with higher education considered certification of pharmacists as mandatory more often than did patients with secondary education. Chi-square test of independence revealed that pharmacists more often than students mentioned mission (the desire to obtain a profession in compliance of own trends, aspirations and inclinations, personal desire, specialty love from childhood) as the main motive of their professional choice (65.5% versus 55.8%). Difference was statistically significant with Chi-square=9.9, $p < 0.002$. The difference between pharmacists and young specialists and young specialists and students wasn't statistically significant. Chi-square test of independent has been performed in order to compare the attitude of different sides to the necessity of pharmacists' certification regulation by Government. Opinion that certification of pharmacists should be mandatory was more common among health care specialists than among chiefs (Chi-square = 45.2, $p < 0.001$) and among pharmacists (Chi-square = 68.9, $p < 0.001$), but the there was no statistically significant difference between chiefs and pharmacists. It was more common also among patients /patients than in pharmacists (Chi-square = 44.2, $p < 0.001$).

Q-2. Are you satisfied with your professional (occupational) choice? Are you satisfied with your profession? On the question-are you satisfied with your professional (occupational) choice? Are you satisfied with your profession? Pharmacist' 57.7% satisfied with professional (occupational) choice, pharmacist' 25.3% partially satisfied with professional (occupational) choice, pharmacists' 4.4% have doubts with professional (occupational) choice, pharmacists' 6 % disappointed with professional (occupational) choice. Pharmacists' 6.5% not satisfied with professional (occupational) choice. See Illustration 1.



Illustration 1. Satisfaction of professional choice of respondents. (Source – study results).

The purpose of the clinical pharmacy statement is to help pharmacists understand pharmaceutical care aspects deeply. Such understanding must precede efforts to implement pharmaceutical care, which is a top priority in all practices. Many pharmacists have embraced the concept of pharmaceutical supply with enthusiasm, but there has also been significant inconsistency in the way it has been described. Directly in the clinical environment, there are



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many goals and tasks that clinical pharmacists can fulfill. The clinical pharmacists work in almost of medical institutions, which contributes to the rational use of drugs and saves drugs. The involvement of a clinical pharmacist is important at all stages of creating a treatment algorithm. A clinical pharmacist is required to participate in the development of a drug use policy, collaborate with specialists in the development of methodological recommendations and guides for the treatment of specific diseases, participation in the sale of drugs and the manufacture of drug formulations in processes and delivering high quality pharmaceutical care services. The structure and composition of the factors has been developed, which taking into account the objective (external), subjective (internal) and universal factors, which effects on the professional formation of the pharmacist. Developed the unity of criteria for pharmacist professional formation, criteria for common professional formation (Characteristic for all stages) and criteria for specific professional formation (characterized for separate stage).

Q-3. Estimate the impact factors, which have influence on your work satisfaction under 5-point scale (system) (estimate each factor). Report on the question - Estimate the impact factors, which have influence on your work satisfaction under 5- point scale (system) (estimate each factor) See Illustration 6 and See Table 1.

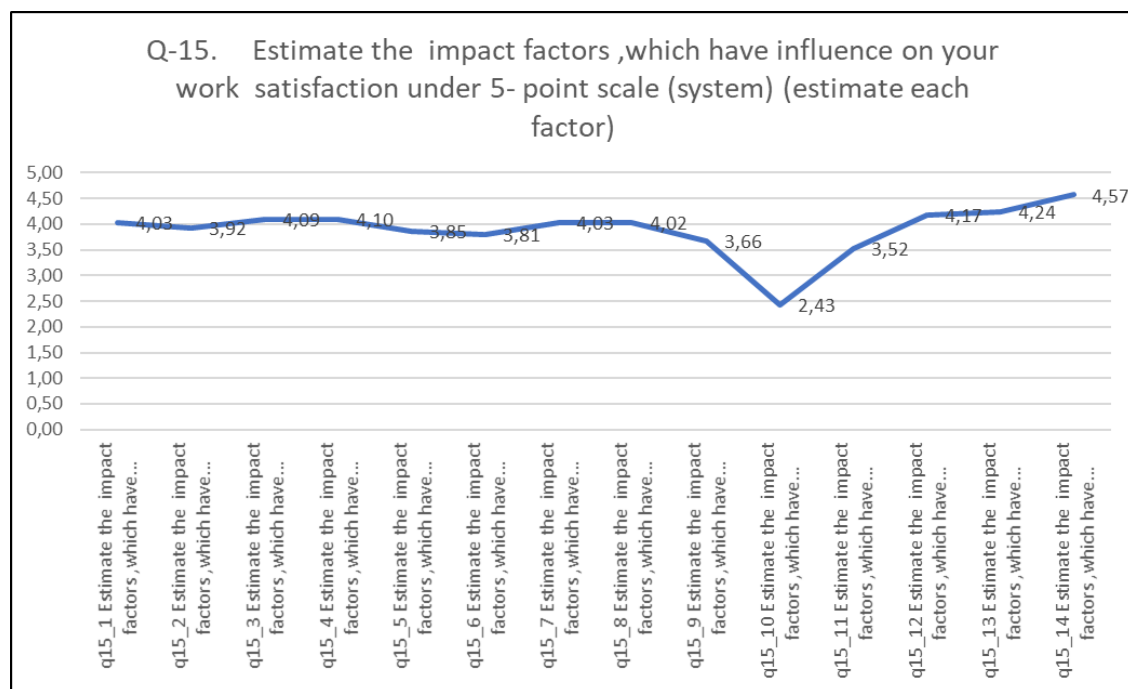


Illustration 1. Report of impact factors, which have influenced on respondents work satisfaction, estimated under 5- point scale (system) (Source – study results).

Only pharmacists with higher pharmaceutical education have the right to work as pharmacists' position in the pharmacies. On the pharmacists' certification programs should be only involved pharmacists who have graduated pharmaceutical faculties from state recognized and accredited universities. It is necessary to provide a deep cooperation between pharmacists and physicians on the issues of pharmacotherapy and healthcare to ensure the patients' health state effective improvement, and also to provide the best feedback regulation and revision in the healthcare



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specialists' team work. Pharmacists also should be responsible for registration of the drugs' side effect, as well as be attentive in case of imperfection and professional defects of drugs they provide. To achieve that it is necessary to raise awareness of specialists on the essence of pharmacists' profession and functions among the medical personnel and general public.

Pharmacists have main role in the drug dispensing processing, pharmacists receive extensive training and are considered experts in various aspects of drug therapy. Therefore, pharmacists are the best sources of drug information. This is particularly important in the context of investigational drugs, where traditional information resources may not be available. The pharmacist plays an important role in ensuring that all parties involved in dispensing, administration, and other supporting roles in the investigational process are trained in the administration of the investigational drug. Pharmacists provide this education by publishing local drug information leaflets that describe important aspects of the drug and how to use it correctly. This document contains a lot of information that may be useful in various real-world research environments. Asking the pharmacist to condense the information into a central, concise document saves time and effort when the information is needed. A complete document should begin with the drug name, all synonyms and abbreviations, and basic pharmacological information. This concerns the mechanism of action and pharmacokinetic parameters. This information may be particularly useful in determining whether side effects experienced during the study may be related to the study drug. Additionally, it should include dosage ranges, treatment regimens, contraindications, monitoring parameters, as well as information on preparation and administration. Additional information on toxicity and how to handle drug interactions may also be included.

4. CONCLUSION

Community pharmacists' activity is at the forefront of medical care, working at their own pharmacies or in the private ones. Pharmacist's job is all about helping the public, as they participate in the medicines distribution and offering advice to patients and maintaining their health. Pharmacist work is a very demanding occupation in the world. Pharmacists usually are greatly honorable members of the society.

Changes in the role of pharmacist and pharmacy community as a medical supplier accelerate along with the fast-moving environment. Today to offer advanced medical services pharmacies deliver educational information at multiple points of contacts and also to raise awareness of the disease are of great importance.

These include over the counter (OTC) and the personal care aisle, a pharmacy counter, specialties publications and pickup areas prescription. These innovations are useful not only for customers' pharmacies but also create opportunities for pharmaceutical marketers, measurable return on investment.

The educative center of occupational programs and schemes growingly identifies the necessity for the possibility to use the knowledge obtained via simulation laboratories or experiential studying, which needs corresponding faculties and personnel conditions to satisfy these educational necessities.

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INTEGRATED ANALYSIS TO ASSESS THE EXCAVATABILITY OF SUBSURFACE GEOMATERIALS USING SEISMIC REFRACTION AND GEOTECHNICAL METHODS IN PERAI, MALAYSIA

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ABSTRACT

Due to naturally varying geological conditions and insufficient data, it is difficult to analyse subsurface parameters for ease of excavation in geo-environmental surveys. The surveys mostly rely on traditional sample digging/drilling, which is costly and arduous, provides single point data, and may result in geologic model misinterpretation. Geophysical surveying techniques, like seismic refraction surveys, on the other hand, are non-destructive, rapid, and multidimensional. As a result, the current study attempted to determine seismic velocities (P-waves) using a seismic refraction survey to generate two-dimensional tomographic cross-sections for the purpose of characterizing various subterranean zones and layers of Jawi site in Perai, Malaysia. Correlation with drilled data from boreholes was performed to estimate the ease of excavation as zones of rippable, non-rippable, and boundary (marginal) and to interpret the geologic units based on seismic velocity and N values as soft to hard geologic conditions approximately 2.2 km/s and 2-50, respectively. The study consisted of low, moderate, and high material strengths, according to both outcomes. Through 2D seismic models, the findings also show multidimensional subsurface diversity. This will eliminate uncertainties brought on by insufficient borehole tests, provide a substantial amount of earth materials in space, and improve the precision of geological models used in building designs and plans.

Keywords: Seismic Refraction, Traditional Method, Material Strength.

1. INTRODUCTION

Estimating the cost and the method of excavation is critical in rippability assessments. Excavation means the act of removing rock fragments from the parent/ main rock and is traditionally carried out using approaches involving rock units being dug, ripped, or blasted (Mohamad et al., 2019; Sparmanto et al., 2023). Amongst the common methods normally employed for excavation, ripping is simply the breakdown of unconsolidated rock masses to detach disjointed material, and has more merits in terms of cost-effectiveness, minimal earth disturbance and degradation, as compared to blasting, breaking the rocks into different sizes with strong force and great earth shaking. Though ripping is considered safe and friendly but has inherent difficulties for decision-making on ripping a rock and its associated cost.

Geophysical method of seismic refraction measures wave velocities of different rock types as it propagates through the complex earth subsurface. The velocity values are embodied on ripper performance chart suggesting the status of rock, rippable, marginal, or non-rippable (Caterpillar



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Tractor Company, 2001). Seismic method is currently employed in rippability investigations due to its non-invasive nature and low cost, by several scholars such as (Aziman et al., 2019; Akingboye & Bery et al., 2022; Sparmanto et al., 2023). Despite the strength of seismic refraction in providing good information with respect to Caterpillar chart, additional information for instance discontinuity spacing and strength affect the excavation (Mohamad et al., 2011). However, current studies by (Muztaza et al., 2022) indicated the usability of seismic approach to evaluate site excavations prior to site development for a quarry. The study revealed that two-dimensional near surface model and the estimated rippability volume of the site were achieved in a cheap and less time-consuming manner. In the same vein, inhomogeneity in rock layering from uneven composition and spread of rock and mineral masses in different parts in granitic quarry area, have been determined through the seismic velocity models (Kausarian et al., 2014).

In different geologic environments and due to complex nature of the subsurface, seismic method aids in providing subsurface information such as weathering, density, porosity, strength, and overall rock mass characteristics, etc., to engineers, geologists and architects and is appropriate to be implemented at project site prior to the construction works. Comparison of geophysical and traditional methods was made by (Olona et. al, 2010), revealing the strength of geophysics through robust characterisation of non-homogeneous rock units. Hazreek et al., 2013, obtained a 2D model generating various information related to stratigraphy and subsurface geologic units. Presently, seismic refraction has proved to be applicable in a wide range of fields, especially for engineering works.

The present study takes into cognizance the strength of seismic refraction method for 2D subsurface model and overburden thicknesses and depth of geologic materials and integrated with traditional method. Though traditional methods, such as geological mapping and geotechnical techniques, for assessing earth's crust, provide real results for rock mass and associated properties, but non-invasive seismic refraction technique is used in multi-dimensional characterisation of complex geologic materials of rocks and soils. It is therefore crucial, to implement seismic refraction technique integrated with traditional methods, to improve field exploration thereby mitigating its challenges of hidden features and one-dimensional information, and cost.

2. MATERIALS and METHODS

The study area is located at Jawi, Seberang Perai Selatan which consist of marine clay, silt and few thin layers of sand (Ariffin et al., 2019) as depicted in Figure 1(a). The seismic refraction consists of the source, which is a sledgehammer of approximately 7000 g, a receiver in form of geophones, and a seismograph. The Mk-8 seismograph was used in the survey as a recording entity, with 24 detectors connected to it and the source was used for striking of a metallic plate for generating signals (Sparmanto et al., 2023). In the present study as depicted in figure 1(a), a seismic refraction survey profile was carried out, (Line1) with total length of each profile 115 m It was presumed that important seismic velocity disparities among granitic rock and overburden (on top of rock) may perhaps be detected. Figure 1(b) depicts the geological setting of the study area with flat topographic changes.

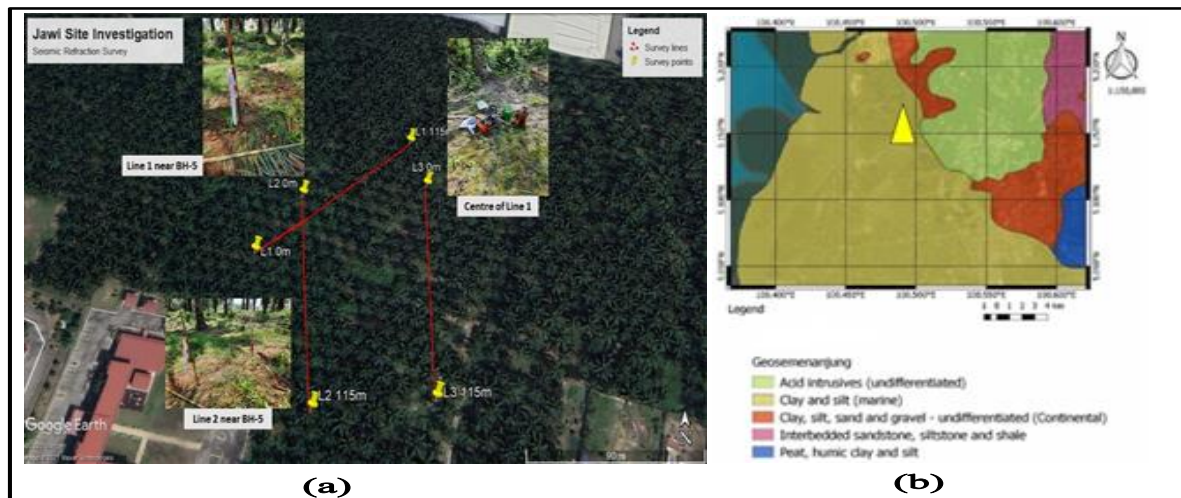


Figure 1(a) A Google map showing the study site and profile layout; (b) Geological map of the study.

3. FINDINGS and DISCUSSION

The 2D seismic refraction and excavability models for the surveyed line were interpreted and correlated with borehole records (Figure 2). The seismic velocity values for the first material range from 0.2 to 1.6 km/s. This material is clay soil with N values ranging from 2 to 7 (from soft to medium stiff condition). The following material has seismic velocity values in the 1.6 – 1.8 km/s range. This area is classified as silty SAND soil with a N value of 8. The third material has seismic refraction values ranging from 1.8 – 2.2 km/s. This material is classified as silty CLAY with an N value range of 11 – 34 respectively. The final material has values ranging from 2.2 – 3.2 km/s. This material is classified as clayey SILT with N values ranging from 38 – 50 (hard condition). Based on their strength properties, the gradual variation and transition in seismic velocity values could be traced back to different subsurface lithological units (Hassan et al., 2021b)

Furthermore, the 2D rippability model obtained and interpreted from the seismic refraction velocities with underground geo-material features, indicating two regions of rippable and moderate rippability (marginal) separated by a border region at velocity of 2.2 km/s where the soil consistency changes from very stiff to hard. The thickness of the rippable layer was estimated to be between 17 and 20 m (from surface).

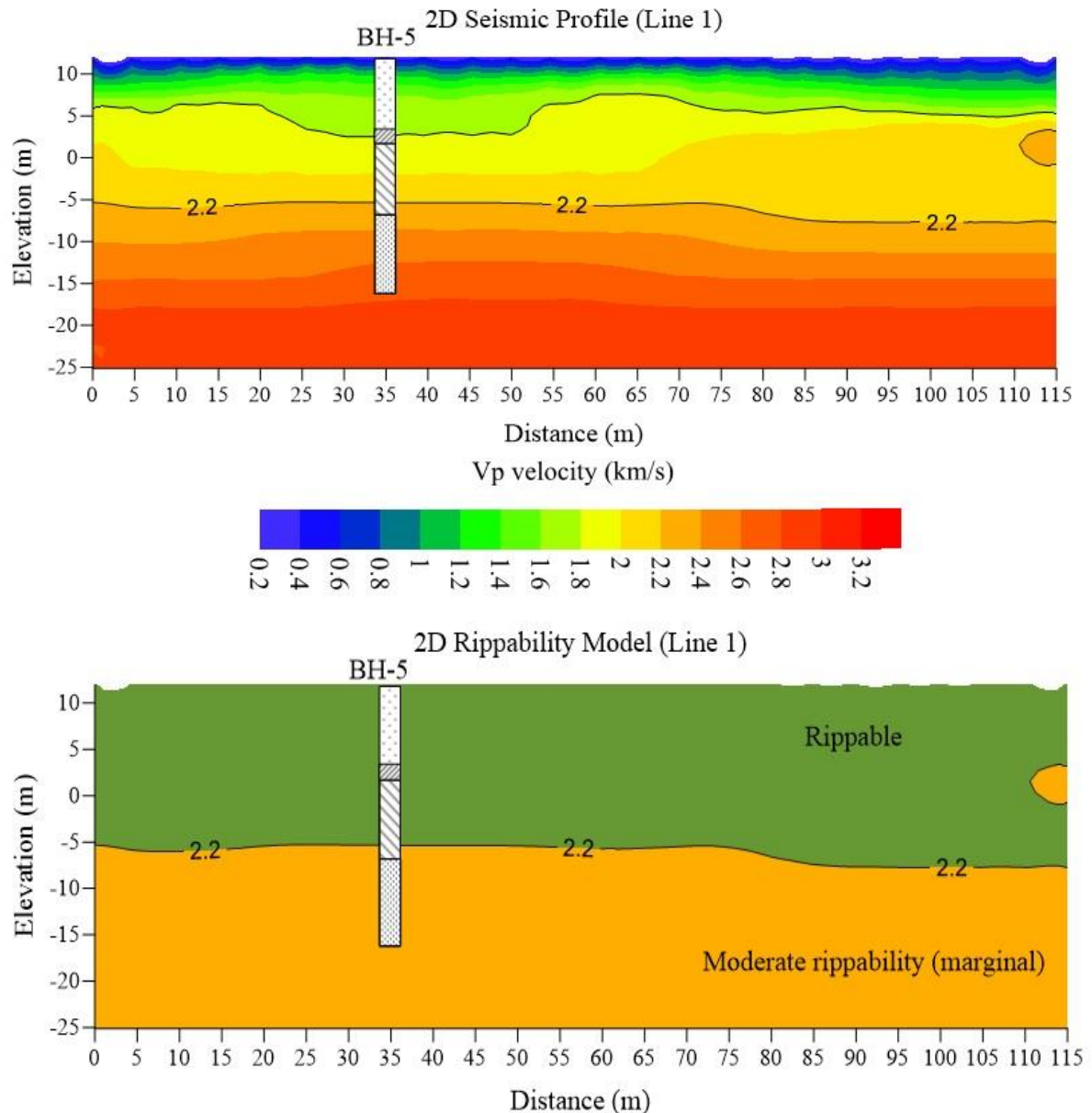


Figure 2: 2D seismic and rippability models for Line 1.

The seismic survey line reveals a vital hidden transition boundary belonging to marginal portion with thickness of about 18 m from the ground surface, which signifies the interface of the rippable and moderate rippability geomaterials, occurring at seismic velocity values of 2.2 km/s. The 2.2 -3.2 km/s moderate rippability region moves downward approaching the bedrock in the study area.

4. CONCLUSION and RECOMMENDATIONS

The methods used in this study have successfully revealed the covered variability of the subsurface as regions of rippable and non-rippable based on the velocity values and borehole data. The seismic results determine the 2D tomographic models, revealing multi-spatial variation of the subsurface. The study examines the natural heterogeneity and strength of the geomaterials from soft to hard rock units of the studied area, based on the seismic velocity



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values and rippability models as critical phase for construction designs of infrastructural development.

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**THE KEY ISSUE ASPECTS RELATED OF ACTION AND OUTLOOK OF USE
MONOCLONAL ANTIBODIES IN MISCELLANEOUS IMMUNOTHERAPEUTIC
DIRECTIONS**

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ABSTRACT

Aim of the research was to study and analyze the key issue aspects related of action and outlook of use monoclonal antibodies in miscellaneous immunotherapeutic directions. Monoclonal antibodies are increasingly becoming a standard part of clinical cancer treatment. Monoclonal antibodies are approved by the Food and Drug Administration for the treatment of cancer in the United States. Oncology nurses are expected to be familiar with these agents, their indications, and their adverse effects, to provide appropriate care and symptom management to patients receiving these agents, and to adequately educate patients and families about these treatments and their specific and overlapping side effects. Most monoclonal antibodies by themselves have little antitumor activity, even after binding to the target antigen. Some notable exceptions include monoclonal antibodies to HER2, EGFR, and CD20, which have remarkable activity against tumors expressing these antigens. However, despite scant antitumor activity of monoclonal antibodies, their specificity for the target antigen makes them useful cancer therapeutic agents. Antitumor activity has been accomplished by conjugating antibodies with different effector molecules that accomplish cell death after antibody binding and



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internalization. Such effector molecules include cytotoxic agents, bacterial or plant protein toxins (immunotoxins), and radiopharmaceutical agents. Monoclonal antibodies targeting specific inflammatory cytokines are undoubtedly revolutionary drugs in many fields of medicine and have begun a new chapter in the treatment of severe and complex cases of immunological diseases. This is also the case in severe asthma, where have moved from demanding and aggravating oral steroid therapy to a targeted and personalized immunological approach. In asthma, the use of monoclonal antibodies has given many patients the chance to control their disease and significantly improve their quality of life. However, there is still a need to develop new therapies that will be effective in more complex and unusual cases, or where existing treatment has not been successful.

Keywords: Aspects, Action, Use, Monoclonal Antibodies, Miscellaneous, Immunotherapeutic, Disease.

1. INTRODUCTION

Monoclonal antibodies (mAbs) are an important therapeutic class with complex pharmacology and interdependent pharmacokinetic (PK) and pharmacodynamics (PD) properties. Understanding the PK and PD of mAbs and their biological and mechanistic underpinnings are crucial in enabling their design and selection, designing appropriate efficacy and toxicity studies, translating PK/PD parameters to humans, and optimizing dose and regimen to maximize success in the clinic. Significant progress has been made in this field however many critical questions still remain. This article gives a brief overview of the PK and PD of mAbs, factors that influence them, and areas of ongoing inquiry (Martin-Aguilar et al., 2022; Scheibe et al., 2022; Beadon et al., 2018; Nobile-Orazio et al., 2014).

Monoclonal antibody (mAb) therapeutics are an important and rapidly growing class of therapeutic agents with over 470 molecules in the clinical pipeline and many more in earlier stages of drug development. Selecting the right mAb is a key determinant of its clinical success and depends on early understanding of its PK/PD and successfully translating it to humans. Compared to small molecules, biologics such as mAbs have unique characteristics that make their pharmacokinetics (PK) and pharmacodynamics (PD) quite complex. An integrated understanding of its PK/PD characteristics including exposure at the site of action, target occupancy and expression of functional pharmacological activity are important in improving its clinical success. The utility of translational PK/PD spans different phases of drug development and can contribute to target evaluation, design and selection of candidate molecule with optimal properties, and dose and regimen selection in preclinical and clinical studies. Understanding PK/PD of mAbs and factors that impact them, are essential to achieve these translational goals. This review describes the PK and PD characteristics of mAbs, and translational PK/PD approaches to predict human PK/PD (Sudo, et al., 2016; Vlam et al., 2015; Thomas et al., 2016; Van Hoecke et al., 2019).

Monoclonal antibodies (mAb) are revolutionising the treatment of many different diseases. Given their differing mode of action compared to most conventional chemotherapeutics and small molecule inhibitors, they possess the potential to be independent of common modes of treatment resistance and can typically be combined readily with existing treatments without



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dose-limiting toxicity. However, treatments with mAb rarely result in cure and so a full understanding of how these reagents work and can be optimised is key for their subsequent improvement. Here we review how an understanding of the biology of the inhibitory Fc receptor, FcγRIIB (CD32B), is leading to the development of improved mAb treatments Shepard et al., 2017; Edwards et al., 2021; Kelley et al., 2022; Li et al., 2013).

Aim of the research was to study and analyze the key issue aspects related of action and outlook of use monoclonal antibodies in miscellaneous immunotherapeutic directions.

2. METHODOLOGY

The material of the article was the revised data from scientific publications, which were processed, analyzed, overviewed and reviewed by generalization and systematization. Research studies are based on a review/overview assessment of the development of critical visibility and overlook of the modern scientific literature. Use the following databases: (for extensive literature searches to identify the key issue aspects related of action and outlook of use monoclonal antibodies in miscellaneous immunotherapeutic directions.) PubMed, Web of Science, Clinical key, Tomson Reuters, Google Scholar, Cochrane Library, and Elsevier Foundations.

3. RESULTS and DISCUSSION

Monoclonal antibodies are essential tools for many molecular immunology investigations. In particular, when used in combination with techniques such as epitope mapping and molecular modelling, monoclonal antibodies enable the antigenic profiling and visualization of macromolecular surfaces. In addition, monoclonal antibodies have become key components in a vast array of clinical laboratory diagnostic tests. Their wide application in detecting and identifying serum analytes, cell markers, and pathogenic agents has largely arisen through the exquisite specificity of these unique reagents. Furthermore, the continuous culture of hybridoma cells that produce these antibodies offers the potential of an unlimited supply of reagent. In essence, when compared with the rather limited supply of polyclonal antibody reagents, the feature of a continuous supply enables the standardization of both the reagent and the assay technique. Clearly, polyclonal and monoclonal antibodies have their advantages and disadvantages in terms of generation, cost, and overall applications. Ultimately, monoclonal antibodies are only produced when necessary because their production is time consuming and frustrating, although greatly rewarding (at least most of the time!). This is especially apparent when a monoclonal antibody can be applied successfully in a routine pathology laboratory or can aid in the clinical diagnosis and treatment of patients Litzow et al., 2013; Stock et al., 2008; Huguet et al., 2009).

Monoclonal antibody-based treatment of cancer has been established as one of the most successful therapeutic strategies for both hematologic malignancies and solid tumors. In addition to targeting cancer antigens antibodies can also modulate immunological pathways that are critical to immune surveillance. Antibody therapy directed against several negative immunologic regulators (checkpoints) is demonstrating significant success in the past few years. Immune checkpoint inhibitors, ipilimumab, pembrolizumab and nivolumab, have shown



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significant clinical benefit in several malignancies and are already approved for advanced melanoma and squamous NSCLC. Based on their mechanism of action, these agents can exert toxicities that are unlike conventional cytotoxic chemotherapy, whose nature is close to autoimmune diseases - immune related adverse events (irAEs). In this review we focus on the spectrum of irAEs associated with immune checkpoint antibodies, discussing the pharmacological treatment strategy and possible clinical impact (Kantarjian et al., 2012; Dworzak et al., 2008; Thomas et al., 2010).

Monoclonal antibodies (mAbs) are a rapidly growing class of human therapeutics representing Cancer diseases are one of the major groups where monoclonal antibodies are used in clinical practice. There have been twelve antibodies that have received approval from the FDA for the treatment of a variety of solid tumors and hematological malignancies. In addition, there are a large number of additional therapeutic antibodies that are currently being tested in early- and late-stage clinical trials. The most common type of mAbs used to treat cancer are “naked mAbs”. Most naked mAbs attach to antigens on cancer cells, but some work by binding to antigens on other, non-cancerous cells, or even free-floating proteins. We can simplify three major mechanisms of actions of naked mAbs. One principle is boosting a person’s immune response against cancer cells by attaching to them and acting as a marker for the body’s immune system to destroy them. An example is alemtuzumab, which binds to the CD52 antigen on lymphocytes and is used to treat some patients with chronic lymphocytic leukemia (CLL). Another naked mAbs work mainly by attaching to and blocking antigens on cancer cells that help cancer cells grow or spread. For example, trastuzumab is an antibody against the HER2 protein (Hoelzer et al., 2010; Carnahan et al., 2010; Leonard et al., 2003).

Since then, monoclonal antibodies have entered almost every branch of biomedical research. Antibodies are now used as frontline therapeutics in highly divergent indications, ranging from autoimmune disease over allergic asthma to cancer. Wider accessibility and implementation of antibody-based therapeutics is however hindered by manufacturing challenges and high development costs inherent to protein-based drugs. For these reasons, alternative ways are being pursued to produce and deliver antibodies more cost-effectively without hampering safety. Over the past decade, messenger RNA (mRNA) based drugs have emerged as a highly appealing new class of biologics that can be used to encode any protein of interest directly in vivo. Whereas current clinical efforts to use mRNA as a drug are mainly situated at the level of prophylactic and therapeutic vaccination, three recent preclinical studies have addressed the feasibility of using mRNA to encode therapeutic antibodies directly in vivo. The highlight the potential of mRNA-based approaches to solve several of the issues associated with antibodies produced and delivered in protein format. We identify key hurdles that mRNA-based approaches still need to take to fulfill this potential and ultimately replace the current protein antibody format (Raetz et al., 2008; Raetz et al., 2011; Advani et al., 2012).

Autoimmune diseases of the peripheral nervous system have so far been treated mainly with exogenous high-dose intravenous immunoglobulins (IVIg), that act through several mechanisms, including neutralization of pathogenic autoantibodies, modulation of lymphocyte activity, interference with antigen presentation, and interaction with Fc receptors, cytokines, and the complement system. Other therapeutic strategies have recently been developed, in part



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to address the increasing shortage of IVIg, prime among which is the use of B cell depleting monoclonal antibodies, or small molecule inhibitors targeting the B-cell specific kinases. Rituximab, a chimeric monoclonal antibody against CD20 + B lymphocytes, is currently the most used, especially in anti-MAG antibody neuropathy and autoimmune neuropathies with antibodies to nodal/paranodal antigens that are unresponsive to IVIg. After several reports of its efficacy in chronic inflammatory demyelinating polyradiculoneuropathy (CIDP), rituximab is currently under investigation in three Phase 2 trials in CIDP. In addition, the possible role of complement activation in the pathogenesis of chronic autoimmune neuropathies has brought into consideration drugs that can block the complement cascade, such as eculizumab, a monoclonal antibody already assessed in acute polyradiculoneuropathies, and approved for myasthenia gravis. Preliminary data on eculizumab in multifocal motor neuropathy have been published, but randomized controlled studies are pending. Moreover, the neonatal Fc receptor, that recycles IgGs by preventing their lysosome degradation, is an important and attractive pharmacological target. Antibodies against FcRn, which reduce circulating IgG (both pathogenic and non-pathogenic) have been developed. The FcRn blocker efgartigimod, a humanized IgG1-derived Fc fragment, which competitively inhibits the FcRn, has recently been approved for the treatment of myasthenia gravis and is currently under investigation in CIDP. In addition, the anti-human FcRn monoclonal antibody rozanolixizumab is currently being assessed in phase 2 trials in CIDP. However, none of the abovementioned monoclonal antibodies is currently approved for treatment of any immune-mediated neuropathies. While more specific and individualized therapies are being developed, the possibility of combined treatments targeting different pathogenic mechanisms deserves consideration as well (Advani et al., 2010; Thorson et al., 2000; Advani et al., 2010).

Monoclonal antibodies have recently gained interest in the treatment of immune-mediated neuropathies, particularly when there is evidence of underlying humoral pathogenic mechanisms.

More data are available for the polyneuropathy with antibodies to myelin-associated glycoprotein (MAG), but increasing evidence is also emerging for other immune-mediated diseases of the peripheral nervous system, including chronic inflammatory demyelinating polyradiculoneuropathy (CIDP) and autoimmune neuropathies with antibodies to nodal and paranodal antigens.

Moreover, a potential pathogenic role of complement in chronic autoimmune neuropathies may open new therapeutic avenues with drugs inhibiting complement activation. Eculizumab, a recombinant humanized monoclonal antibody that binds and sequesters C5a, prevents its enzymatic cleavage by the C5 convertase into C5a and C5b, thus inhibiting C5b-9 membrane attack complex (MAC) formation. Eculizumab has already been approved in myasthenia gravis and is under investigation in acute polyradiculoneuropathies. A further potential therapeutic target in immune-mediated polyneuropathies is the neonatal Fc receptor (FcRn), known to facilitate IgG recycling and protection from degradation, thereby extending the half-life of IgG molecules. High-dose intravenous immunoglobulins (IVIg), currently used in several immune-mediated diseases, act through several mechanisms, including competition with pathogenic autoantibodies for FcRn binding, saturating the receptor and thus increasing IgGs turnover.



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Monoclonal antibodies against FcRn may be effective in reducing serum levels of pathogenic IgG autoantibodies without removing other circulating factors. The FcRn blocker efgartigimod has recently been approved by the U.S. Food and Drug Administration for the treatment of anti-acetylcholine receptor antibody positive myasthenia gravis and is currently under investigation in CIDP (Kantarjian et al., 2012; O'Brien et al., 2012; Nagorsen et al., 2012).

However, even if they hold promise, none of the above-mentioned therapeutic monoclonal antibodies are currently approved for treatment of any of the immune-mediated neuropathies. We reported on the currently used monoclonal antibodies in the treatment of chronic immune-mediated neuropathies, and present preliminary data on new potential therapeutic strategies.

Antibody-drug conjugates are monoclonal antibodies conjugated to cytotoxic agents. They use antibodies that are specific to tumour cell-surface proteins and, thus, have tumour specificity and potency not achievable with traditional drugs. Design of effective antibody-drug conjugates for cancer therapy requires selection of an appropriate target, a monoclonal antibody against the target, potent cytotoxic effector molecules, and conjugation of the monoclonal antibody to cytotoxic agents. Substantial advances in all these aspects in the past decade have resulted in regulatory approval of ado-trastuzumab emtansine and brentuximab vedotin for clinical use. Several promising antibody-drug conjugates are now in late-phase clinical testing. Ongoing efforts are focused on identifying better targets, more effective cytotoxic payloads, and further improvements in antibody-drug linker technology. Improved understanding of the mechanistic basis of antibody-drug conjugate activity will enable design of rational combination therapies with other agents, including immunotherapy (Goebeler et al., 2011; Topp et al., 2012; Topp et al., 2012).

Most monoclonal antibodies by themselves have little antitumour activity, even after binding to the target antigen. Some notable exceptions include monoclonal antibodies to HER2, EGFR, and CD20, which have remarkable activity against tumours expressing these antigens. However, despite scant antitumour activity of monoclonal antibodies, their specificity for the target antigen makes them useful cancer therapeutic agents. Antitumour activity has been accomplished by conjugating antibodies with different effector molecules that accomplish cell death after antibody binding and internalisation. Such effector molecules include cytotoxic agents, bacterial or plant protein toxins (immunotoxins), and radiopharmaceutical agents (Kreitman et al., 2011; Wayne et al., 2010).

New biologic therapies come in several basic forms, either growth factors and cytokines (such as erythropoietin, G-CSF, interferon, enzymes, factors that regulate coagulation) or, more commonly, monoclonal antibodies (mAbs) and related proteins such as 'traps' in which cytokine receptors are made soluble and fused with antibody constant regions. The latter group (mAbs and traps) have dramatically advanced the therapy of chronic inflammatory diseases and cancer. We describes mAbs and relatives in different direction of therapeutics. The tumour necrosis factor (TNF)-blockers for autoimmune/inflammatory diseases are the most broadly deployed (with multiple products) and have engendered a revolution in therapeutic research/development, along with rather remarkable revenues. This therapeutic revolution is based on the synergy of three scientific disciplines: immunology, molecular biology and protein engineering (Wayne et al., 2011; Herrera et al., 2009; Park et al., 2010).

Monoclonal antibody (mAb) therapies for treatment of patients with COVID-19 have been launched at an unprecedented pace by multiple companies, delivering clinically meaningful



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interventions since. Emergency-use authorization (EUA) has been granted by many countries in record-time allowing hundreds of thousands of patients to benefit. What was once an audacious goal and medical imperative to develop and deliver mAb therapies early in the pandemic has now come to pass (Park et al., 2010; Porter et al., 2011).

This is an amazing achievement for the pharmaceutical industry and regulatory health authorities and speaks to the maturation and broad acceptance of mAbs as therapeutics. Without question, delivering these mAbs in record time was only made possible by the industry convergence on mAb platform processes and each company's existing manufacturing networks. This review will share experiences from our COVID-19 journey at Vir Biotechnology and GlaxoSmithKline to develop sotrovimab and other antiSARS-CoV-2 mAbs and include perspectives from other companies that have been shared publicly in nearly two years since the COVID-19 pandemic began. We consider how will the experiences catalyze changes to the development of future mAb products. Informed by production history and approved of over 100 licensed mAbs. The implications chemistry, manufacturing, and control (CMC) development strategies for COVID-19 mAbs may have for development of future mAb products (Kochenderfer et al., 2012; Haso et al., 2012).

Patients with moderate-to-severe asthma may now be treated using a variety of monoclonal antibodies that target key inflammatory cytokines involved in disease pathogenesis. Existing clinical data on anti-IgE, anti-IL-5 and other immunological pathways indicate these therapies to offer reduced exacerbation rates, improved lung function, greater asthma control and better quality of life. However, as several patients still do not achieve satisfactory clinical response with the antibodies available, many more biologics, aiming different immunological pathways, are under evaluation. This review summarizes recent data on existing and potential monoclonal antibodies in asthma. Recent advances have resulted in the registration of a new antibody targeting (tezepelumab), with others being under development. Some of the researched monoclonal antibodies (e.g. anti-IL-13 tralokinumab and lebrikizumab or anti-IL-17A secukinumab) have shown optimistic results in preliminary research; however, these have been discontinued in asthma clinical research. In addition, as available monoclonal antibody treatments have shown little benefit among patients with T₂-low asthma, research continues in this area, with several antibodies in development. This article summarizes the available pre-clinical and clinical data on new and emerging drugs for treating severe asthma, discusses discontinued treatments and outlines future directions in this area (Han et al., 2013; Dank et al., 2013).

Lebrikizumab is humanized IgG4 monoclonal antibody targeting IL-13 that has been intensively studied in moderate-to-severe asthma. It has been evaluated in several phase II and phase III studies. In phase II studies it has demonstrated reduced exacerbation rates and improved FEV1 in patients with uncontrolled asthma, particularly among those with high periostin concentration or blood eosinophil count.

Brodalumab is a human, IgG2 monoclonal antibody targeting IL-17RA, which is currently registered for the treatment of psoriasis vulgaris, psoriatic arthritis, pustular psoriasis and psoriatic erythroderma. The drug was studied in a randomized, double-blind phase II study with 315 participants in four groups: placebo, brodalumab 140 mg, brodalumab 210 mg and brodalumab 280 mg. No clinically significant differences were observed between the groups in terms of ACQ score, FEV1, morning PEF, SABA use, daily and nighttime symptom scores or symptom-free days. A predefined subgroup analysis found that only the high bronchodilator



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reversibility subgroup demonstrated clinically significant benefits (Stopforth et al., 2016; Bruhns et al., 2009).

Anakinra is a human IL-1 receptor antagonist produced by recombinant DNA technology in an *E. coli* expression system. As the IL-1-regulated pathway is believed to play a significant role in asthma pathogenesis in both Th2/Th17-high and –low phenotypes, it has become an attractive therapeutic target. However, two recent clinical trials that were designed to assess the effectiveness of anakinra as a rescue treatment for airway inflammation in allergic asthma, either through early- or late-phase administration after allergen challenge (Lim et al., 2011; Budde et al., 2014).

Monoclonal antibodies targeting specific inflammatory cytokines are undoubtedly revolutionary drugs in many fields of medicine and have begun a new chapter in the treatment of severe and complex cases of immunological diseases. This is also the case in severe asthma, where have moved from demanding and aggravating oral steroid therapy to a targeted and personalized immunological approach. In asthma, the use of monoclonal antibodies has given many patients the chance to control their disease and significantly improve their quality of life. However, there is still a need to develop new therapies that will be effective in more complex and unusual cases, or where existing treatment has not been successful (Brooks et al., 2019; Goede et al., 2014).

Monoclonal antibodies (mAbs) have shown impressive therapeutic benefit for a range of diseases including cancer, autoimmune disease and infectious disease. As such, they are the fastest growing sector in the biopharmaceutical market, with over \$100B in sales each year and a projection to double that within the next several years.¹ Today, the market for mAbs is overwhelming high-income countries. The majority of the more than 500 mAbs now in clinical testing⁵ are for oncology and autoimmune indications. However, with the recent clinical success and regulatory approvals of mAbs for Ebola virus disease and COVID-19, neglected infectious diseases are anticipated to represent a significant percentage of the future therapeutic antibody market. Currently, there are over 75 clinical trials of mAbs against ~20 infectious pathogens and mAbs for ~70 pathogens in preclinical development.² These include mAbs against SARS-CoV-2, HIV, influenza, respiratory syncytial virus (RSV), filoviruses, viral enteric pathogens and gram negative bacterial enteric pathogens, including *E.coli*, *Klebsiella*, *Shigella* and *Salmonella* (White et al., 2011; Li et al., 2011; Clynes et al., 2000).

The monoclonal antibody (mAb) against CD20 known as Rituxan is widely used to treat autoimmune diseases and lymphomas. However, further application of Rituxan faces challenges of high production cost, which limits its availability in developing countries. The report a new approach for large production of a recombinant anti-CD20 mAb in the milk of transgenic cattle (at a yield of up to ~6.8 mg/mL), with recovery rate and purity. Crystallography study showed that our recombinant mAb is structurally nearly identical to Rituxan with only minor differences in N-linked glycosylation pattern. Functional study showed that, while our mAb shared similar target-cell binding capacities and complement-dependent cytotoxicity with Rituxan, our product exhibited a higher binding affinity for Fc γ RIII α and a greater antibody-dependent cellular cytotoxicity. Accordingly, our recombinant mAb demonstrated a superior efficacy over Rituxan against B-cell lymphomas in severe combined immunodeficiency mice. Taken together, our data supports transgenic cattle as a novel model for cost-competitive, large-scale production of therapeutic antibodies (Nimmerjahn et al., 2005; DiLillo et al., 2015).



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Monoclonal antibodies (mAbs) comprise an essential type of biologic therapeutics and are used to treat diseases because of their anti-cancer and anti-inflammatory properties, and their ability to protect against respiratory infections. Its production involves post-translational glycosylation, a biosynthetic process that conjugates glycans to proteins, which plays crucial roles in mAb bioactivities including effector functions and pharmacokinetics. These glycans are heterogeneous and have diverse chemical structures whose composition is sensitive to manufacturing conditions, rendering the understanding of how specific glycan structures affect mAb bioactivity challenging. There is a need to delineate the effects of specific glycans on mAb bioactivity to determine whether changes in certain glycosylation profiles (that can occur during manufacturing) will significantly affect product quality. Using enzymatic transglycosylation with chemically-defined N-glycans, we show that galactosylation at a specific location of N-glycans in an afucosylated anti-viral mAb is responsible for FcγRIIIA binding and antibody-dependent cell-mediated cytotoxicity (ADCC) activity. We reported a facile method to obtain purified asymmetric mono-galactosylated biantennary complex N-glycans, and their influence on bioactivity upon incorporation into an afucosylated mAb. Using ELISA, surface plasmon resonance and flow cytometry, we show that galactosylation of the α6 antenna, but not the α3 antenna, consistently increases FcγRIIIA binding affinity. To confirm its relevance in an anti-viral model of respiratory syncytial virus (RSV) using an adapted ADCC reporter assay. Further correlate the structure-function relationship to the interaction of the galactose residue of the α6 antenna with the protein backbone using 2D-¹H-¹⁵N-NMR, which showed that galactosylation at this location exhibited chemical shift perturbations compared to glycoforms lacking this galactose residue. Our results highlight the importance of identifying and quantifying specific glycan isomers to ensure adequate quality control in batch-to-batch and biosimilar comparisons (Schwab et al., 2015; Hargreaves et al., 2015).

The targeting of a single pro-inflammatory cytokine, TNF, to treat a complex disease in rheumatoid arthritis (RA) where multiple pro-inflammatory cytokines were upregulated was based on work using human disease tissue. They analyzed cytokine production from joints and cytokine regulation in cultures of rheumatoid synovium in which the majority of the cells survived, producing the mediators generated *in vivo*. In these cultures, blocking TNF-α reduced the production of many other inflammatory cytokines (IL-1, IL-6, GM-CSF, IL-8 etc), thus defining a 'TNF-dependent cytokine cascade'. The dramatic clinical success of TNF blockade, demonstrated first in late-stage RA then in earlier stage disease, also validated this concept. Noteworthy was the fact that tissue (bone and cartilage) damage was controlled. But also striking was the heterogeneity of the clinical response, with some individuals close to a cure and others virtually unimproved. The reasons for this are not yet clear, despite much work to try to elucidate the reasons. Genetic differences were an obvious possibility although never established, and recent clinical data demonstrating that non-responders may respond subsequently to anti-TNF has excluded it. Although anti-TNF in humans is relatively safe, more infections in patients occur, eg with intracellular organisms, especially tuberculosis. Many large patient registers have documented the long-term benefits of anti-TNF therapy, reduced some complications and maintained a favourable benefit/risk ratio (Nelson et al., 2000; Burioni et al., 2013; Levene et al., 2005).

Currently, anti-TNF is used in RA, Crohn's disease, ulcerative colitis, psoriasis, psoriatic arthritis, ankylosing spondylitis and juvenile RA; its use is now being explored in other indications. Anti-TNF antibodies are the most successful and widely used antibody-based



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therapeutic. It is noteworthy that if used together with methotrexate early in the course of RA, over 50% of patients can be taken off infliximab and remain virtually disease-free, even with reduced dosage of methotrexate, and some patients can be taken off all medication.

At present, therapeutic monoclonal antibodies are being used in haematological and solid malignancies including non-Hodgkin's lymphoma, breast cancer and colorectal cancer. The mechanism of their antitumour effect is not precisely known but is thought to include complement-dependent cytotoxicity, antibody-dependent cellular cytotoxicity and blocking or steric hindrance of the function of the target antigen. This review focuses on current use in oncology but lists some of the antibodies in clinical development (Byrd et al., 2001; Brien et al., 2001).

Rituximab, a chimeric mAb to CD20, (an antigen in most B-cells although not plasma cells), was first to treat B-cell-driven cancers such as non-Hodgkin lymphoma. It was pioneered by Jo Edwards for RA and subsequently approved, but was not successful in systemic lupus erythematosus (SLE) trials. Anti-CD52 (alemtuzumab) is a first-generation humanised antibody, now used in multiple sclerosis. There are other antibodies approved, eg belimumab (also known as Benlysta) is an anti-BLys mAb approved for SLE, ustekinumab (also known as Stelara) is an antibody to the shared p40 subunit of IL-12 and IL-23 approved for psoriasis and psoriatic arthritis and potentially for Crohn's disease, and secukinumab (Cosentyx) is an anti-IL17A mAb approved for severe psoriasis and ankylosing spondylitis (Hainsworth et al., 2003; Kamath et al., 2016).

Modern mAb therapy of solid tumours was initiated by the humanised human epidermal growth factor receptor 2 (HER2) mAb trastuzumab. The science that laid the foundation for this breakthrough mAb also initiated personalised/biomarker driven drug discovery and treatment in oncology (Epenetos et al., 2009; Hiatt et al., 2014).

Trastuzumab, the first successful monoclonal anti-cancer antibody to be successful against solid tumours, is well tolerated in patients. The pathway leading to TNF-resistance of most tumour cell lines was unraveled by collaboration between the Shepard (Genentech) and Schreiber laboratories (Chicago), which revealed that macrophages kill tumor cells largely by secreting TNF. They hypothesised that if tumour resistance to macrophages could be reversed, the tumors would become sensitive to killing by host defense. Macrophage (or TNF)-resistant tumour cells implanted into syngeneic mice formed aggressive tumors, while their TNF-sensitive parental cells regressed (Demlova et al., 2016; Drewe et al., 2002).

Biologic therapies targeting B-cells are emerging as an effective strategy to treat a variety of immune-mediated diseases. One of the most studied B-cell-targeted therapies is rituximab, an anti-CD20 monoclonal antibody that exemplifies B-cell depletion therapy and has served as the prototype for other anti-CD20 monoclonal antibodies and the development of biosimilars. While there are multiple studies on the use of rituximab in dermatology, a comprehensive review of rituximab therapy in autoimmune skin conditions is lacking. In this literature review, we summarize indications, treatment efficacy, and safety of rituximab among common autoimmune diseases of the skin: pemphigus vulgaris, cutaneous lupus erythematosus, dermatomyositis, systemic sclerosis, thyroid dermopathy, autoimmune pemphigoid diseases, and cutaneous vasculitis diseases. Existing data on rituximab support the approach of rituximab, biosimilars, and newer B-cell-targeting therapies in immune-mediated cutaneous diseases. Overall, rituximab, which targets CD20, provides an effective alternative or concomitant option



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to traditional immunosuppressants in the management of various autoimmune diseases of the skin. Further studies are necessary to expand the understanding and possible utility of B-cell-targeted therapies among autoimmune skin diseases (Smith et al., 2023; Lycke et al., 2022).

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Monoclonal antibodies have become the main type of antibody drug because of their high specificity and strong affinity to antigen. However, with the intensive study of the natural monoclonal antibody, many defects have faced, such as the limit times of binding to antigen, the unanticipated antibody clearance and antigen accumulation. Therefore, studies are no longer limited to the natural antibody screening, but rather to improve the efficiency of antibody drugs by engineering. In recent years, the bottlenecks in the development of conventional antibody have been solved effectively since the discovery of a novel recycling antibody. Recycling antibody binds to an antigen in plasma and dissociates from the antigen in endosome, thus maximizing the use of antibody and reducing antigen-mediated antibody clearance and antibody-mediated antigen accumulation. In addition, recycling antibodies can enhance the affinity with Fc receptors through further Fc modification (Mishima et al., 2011; Sickmier et al., 2016).

The mechanism of TNF-resistance of tumours needed to be widespread since most tumour cell lines were resistant. Sporn and Todaro's autocrine growth factor hypothesis of malignant transformation involving autocrine stimulation by transforming growth factors seemed plausible. Various growth factors were combined with TNF on TNF-sensitive tumour cell lines and growth factors that activated receptor tyrosine kinases converted TNF-sensitive tumour cells to TNF-resistant cells. Host defence was completely subverted and the growth inhibitor (TNF) even became a growth factor (Patel et al., 2007 Czuczman et al., 2008).

Much progress has been made during the last few decades in the treatment of malignancies. Many types of cancer cells comprising the tumor mass carry molecular markers that are not expressed or are expressed at much lower levels in normal cells. These findings provide new leads to drug design and development of therapeutic strategies involving monoclonal antibodies (mAbs) or related antibody drugs to treat malignancies. This article reviews recent advances in this targeting approach with a focus on the evolution and current use of prospective antibody drugs as effective ways to treat cancer (Nijhof et al., 2016; Seo et al., 2014).



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Monoclonal antibody-based therapies bring the promise of increased response rates without excessive toxicity. The addition of rituximab to combination chemotherapy has shown encouraging results. Newer monoclonal antibody-based therapies linked to cytotoxic agents show promise. These include inotuzumab ozogamicin, an anti-CD22 antibody linked to calicheamicin that has produced significant single-agent responses in relapsed and refractory. Other monoclonal antibodies linked to plant or bacterial toxins are in earlier stages of development. Blinatumomab is a novel bispecific T-cell engaging antibody that combines single chain antibodies to CD19 and CD3 and brings a T cell in close proximity to a leukemic lymphoblast with resulting redirected lysis. This agent has demonstrated encouraging results in both the minimal residual disease setting and the relapsed/refractory setting. Autologous chimeric antigen receptor cells have shown promising responses in indolent B-cell lymphoid malignancies and are being tested in ALL. Many of these agents have the potential to increase response rates in older adults. Trials of many of these monoclonal antibody-based therapies are in various stages of development in the treatment of newly diagnosed (Lee et al., 2009; Braig et al., 2017).

The term monoclonal antibody refers to a single specificity antibody derived from a single B cell clone and initially these were created by fusing B cells (from immunised mice) with lymphoma cells. In clinical practice, however, the administration of murine antibodies induces human antimouse antibodies that may lead to allergic reactions and reduced efficacy. These difficulties have been partially overcome by recombinant technology to develop less immunogenic monoclonal antibodies. Chimaeric antibodies contain only a murine variable fragment whereas humanised antibodies only have a murine complementarity determining region (Nakadate et al., 2014; Valabrega et al., 2007).

Immunotoxins are recombinant proteins consisting of an antibody or antibody fragment targeting the tumour antigen, linked to protein toxins such as diphtheria toxin or pseudomonas exotoxin A.1 Up to now, the only immunotoxin approved by the US Food and Drug Administration (FDA) is denileukin diftotox for treatment of CD25-positive cutaneous. Another immunotoxin, moxetumomab pasudotox, targeting CD22 has shown substantial activity in patients with hairy cell leukaemia and is now being assessed in a multicentre trial in patients with relapsed or refractory hairy cell leukaemia. In the case of solid tumours, immunotoxins have been less effective mainly because they induce an immune response restricting their activity. However, major tumour regressions were reported with an anti-mesothelin immunotoxin, in patients with treatmentrefractory mesothelioma when it was given in combination with pentostatin and cyclophosphamide (Gennari et al, 2004; Kasper et al., 2017).

Antibody–drug conjugates make use of antibodies that are specific to tumour cell-surface proteins⁶ and have tumor specificity and potency not achievable with traditional drugs. Although the idea of linking drugs to tumor-targeted antibodies was clear, development of therapeutic antibody–drug conjugates needed several technological advancements. Early antibody–drug conjugates were mouse monoclonal antibodies covalently linked to anticancer drugs such as doxorubicin, vinblastine, and methotrexate. These conjugates had little success in clinical trials because of immunogenicity, scant potency, suboptimum target selection, and insufficient selectivity for tumour versus normal tissue. The lessons from these early efforts led to improvements in technology and renewed interest in antibody–drug conjugates. Replacing murine antibodies with humanised or fully human antibodies prevented immunogenicity. Potency was improved by using drugs that were 100–1000 times more potent. Careful target



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and antibody selection improved selectivity and efficiency of internalization (Cuyàs et al., 2017; Ozawa et al., 2017).

Ado-trastuzumab emtansine is an antibody–drug conjugate composed of trastuzumab and DM1, a maytansine derivative that is conjugated covalently to the antibody via a stable thioether linker. On binding to HER2, ado-trastuzumab emtansine undergoes receptor-mediated internalisation and subsequent proteolytic digestion, releasing the cytotoxic antimicrotubule agent within the target cells. Furthermore, it blocks HER2-mediated signal transduction, facilitates antibody-dependent cell-mediated cytotoxicity, and inhibits shedding of the HER2 extracellular domain.⁴³ Ado-trastuzumab emtansine was approved as a single agent for the treatment of patients with HER2-positive metastatic breast cancer who had previously received trastuzumab and a taxane, separately or in combination. The recommended dose of ado-trastuzumab emtansine is 3.6 mg/kg, administered as an intravenous infusion every 3 weeks (Xue et al., 2016; Kong et al., 2019).

Infliximab may be maintained during and eight weeks after repeated doses. These clinical improvements were accompanied by considerable healing of endoscopic lesions, although healing with stricture formation remains a concern. Histological disease activity was also dramatically reduced, with a decrease in inflammatory cell infiltrate and downregulation of activation markers and adhesion molecules occurring after treatment.

Etanercept is another anti-TNF agent licensed and effective for the treatment of refractory RA. Etanercept is a recombinant IgG1 Fc fragment fused to two p75 TNF receptors, as opposed to a monoclonal antibody. Etanercept has also been used as monotherapy in early RA, where it has comparable efficacy to methotrexate alone.¹⁵ It is given as a twice weekly subcutaneous injection.

Both Etanercept and Infliximab appear to reduce radiographical joint disease progression. The role of these biological agents in the treatment hierarchy still needs to be established, and currently they are likely to be used only for patients who have active disease despite previous use of at least two conventional disease modifying drugs. Etanercept has also been studied in psoriatic arthritis, where improvements in both joint pain and swelling and skin lesions have been demonstrated (Chandarlapaty et al., 2012; Jazirehi et al., 2007; Schmitz et al., 2015).

2007 Most patients with low grade or follicular lymphoma relapse with current treatments. Rituximab is a mouse human chimaeric IgG1 antibody that recognises the transmembrane phosphoprotein CD20 expressed by B cells and their related lymphomas. An infusion of Rituximab dramatically reduces circulating B cell numbers, through antibody dependent cellular cytotoxicity or apoptosis. Normal CD20 positive B cells are regenerated from early pre-B or stem cells (CD20 negative) in contradistinction to tumour cells, which have no equivalent counterpart.

The clinical benefits of monoclonal antibodies have been demonstrated, in particular, in patients with more severe disease, and often as an adjunct to standard treatments. In many instances, the regimens for these licensed monoclonal antibodies still need to be refined. The costs of monoclonal antibody treatment remain high but must be weighed against the potential gains in reducing disability, hospitalisation, and mortality.

While mAb has success as a monotherapy in some patients, treatment paradigms are trending towards employing them as combinations with chemotherapy, radiation, molecularly targeted



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drugs such as tyrosine kinase inhibitors, other antibodies against the same target, immune checkpoint inhibitors, vaccines, and/or cellular therapies. These many combination strategies are currently undergoing both preclinical investigation and clinical trials and this vast field is more exhaustively covered elsewhere. The cover combination therapies involving multiple monoclonal antibodies. It is now widely recognized that the mechanism of action of monoclonal antibodies includes an immune effector cell component. In particular, cetuximab efficacy has been partly attributed to ADCC, which can link innate and adaptive anti-tumor immune responses. Destruction of tumor cells via NK cell-mediated ADCC releases tumor cell specific proteins that when presented by antigen presenting cells to cytotoxic T cells leads to a more effective anti-tumor response. Head and neck squamous cell carcinoma (HNSCC) patients with durable responses to cetuximab have sustained anti-tumor specific immune responses. With the rise of immune checkpoint inhibitors that can further potentiate such immune responses, it is hypothesized that ICB may act in a synergistic manner with cetuximab. There is growing support combining anti-PD-1/PD-L1 mAbs with cetuximab in HNSCC patients. Additionally, combinations of either pembrolizumab or avelumab with cetuximab are currently in clinical trials. Likewise, the use of ICB in breast cancer in order to enhance anti-HER2 mAb therapies is a promising strategy. In fact, preclinical evidence suggests that resistance to trastuzumab monotherapy can be overcome by combination with ICB. Based on those results several clinical trials were formed to investigate the relationship between ICB and HER2-targeted mAbs. Preliminary results from the phase I/II PANACEA trial, which tested pembrolizumab combined with trastuzumab in treating breast cancer patients who overexpressed HER2, indicated synergy in the PD-L1+ patient subset.

Although there are many immune checkpoints of T-cell activation, each checkpoint has distinct mechanisms. Consequently, ICB combinations that target multiple checkpoints will enhance T cell responses in a synergistic manner. The combination of mAbs targeting CTLA-4 and PD-1 performed significantly better in preclinical mouse models than either antibody alone. Similarly, in metastatic melanoma patients combined therapy of ipilimumab and nivolumab was found to be more effective than either treatment used as a monotherapy. The FDA has since approved the combination of ipilimumab and nivolumab for melanoma. As the first ICB combination with FDA approval, ongoing clinical trials continue to evaluate ipilimumab plus nivolumab in other cancer types.

Anti-PD-1 mAbs are most often used in combinatorial strategies due to their more favorable toxicity profile in contrast to anti-CTLA-4 monoclonal antibodies. The immune checkpoints LAG3 and TIM3 are commonly found co-expressed with PD-1 on exhausted T cells. ICB of LAG3 combined with anti-PD-1 is undergoing clinical trial in glioblastoma and other cancers. There are similar clinical trials for the combination of anti-TIM3 and anti-PD-1 antibodies in liver cancer and several other solid tumors. Another promising combination strategy involves uniting ICB with agonistic antibodies that activate stimulatory receptors. 4-1BB is a costimulatory receptor found on T cells and NK cells and clinical trials that evaluate 4-1BB agonist antibodies in combination with anti-PD-1 mAb therapy are underway. An agonist antibody to the glucocorticoid-induced tumor necrosis factor receptor-related protein (GITR), which promotes T cell activation, also proved to be successful when combined with nivolumab.



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Additional mAb combinations that include agonist antibodies to OX40, which only becomes expressed on activated T cells, are the subject of multiple clinical trials.

Antibody therapy is effective for treating infectious diseases. Due to the coronavirus disease 2019 (COVID-19) pandemic and the rise of drug-resistant bacteria, rapid development of neutralizing monoclonal antibodies (mAbs) to treat infectious diseases is urgently needed. Using a therapeutic human mAb with the lowest immunogenicity is recommended, because chimera and humanized mAbs are occasionally immunogenic. In order to directly obtain naïve human mAbs, there are three methods: phage display, B cell receptor (BCR) cDNA sequencing of a single cell, and antibody-encoding gene and amino acid sequencing of immortalized cells using memory B cells, which are isolated from human peripheral blood mononuclear cells of healthy, vaccinated, infected, or recovered individuals. After screening against the antigen and performing neutralization assays, a human neutralizing mAb is constructed from the antibody-encoding DNA sequences of these memory B cells. This review describes examples of obtaining human neutralizing mAbs against various infectious diseases using these methods. However, a few of these mAbs have been approved for therapy. Therefore, antigen characterization and evaluation of neutralization activity *in vitro* and *in vivo* are indispensable for the development of therapeutic mAbs. These results will accelerate the development of antibody drug as therapeutic agents.

Two points in the strategy to develop therapeutic human neutralizing mAbs need to be considered. One is to thoroughly characterize the antigen. It is necessary to clarify which domain yields the mAb with the highest neutralization activity because mAbs acquired via highly antigenic antigens do not always have high neutralization activity. Moreover, obtaining mAbs against various epitopes is also important to enhance neutralization activity. In some cases, neutralization activity can be dramatically improved by making a cocktail containing multiple mAbs with different targets. When developing a cross-reactive neutralizing mAb, it is suitable to use an antigen containing a sequence that is conserved across different species not only in the primary structure but also in the tertiary structure. Another point is to evaluate the neutralization activity *in vitro* and *in vivo*. AED must always be considered when developing human mAb therapeutic agents.

Monoclonal antibodies have become a mainstay in the treatment of patients with relapsing multiple sclerosis (RMS) and provide some benefit to patients with primary progressive MS. They are highly precise by specifically targeting molecules displayed on cells involved in distinct immune mechanisms of MS pathophysiology. They not only differ in the target antigen they recognize but also by the mode of action that generates their therapeutic effect. Natalizumab, an integrin antagonist, works via binding to cell surface receptors, blocking the interaction with their ligands and, in that way, preventing the migration of leukocytes across the blood-brain barrier. On the other hand, the anti-CD52 monoclonal antibody alemtuzumab and the anti-CD20 monoclonal antibodies rituximab, ocrelizumab, ofatumumab, and ublituximab work via eliminating selected pathogenic cell populations. However, potential adverse effects may be serious and can necessitate treatment discontinuation. Most importantly, those are the risk for (opportunistic) infections, but also secondary autoimmune diseases or malignancies. Monoclonal antibodies also carry the risk of infusion/injection-related reactions,



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primarily in early phases of treatment. By careful patient selection and monitoring during therapy, the occurrence of these potentially serious adverse effects can be minimized. Monoclonal antibodies are characterized by a relatively long pharmacologic half-life and pharmacodynamic effects, which provides advantages such as permitting infrequent dosing, but also creates disadvantages regarding vaccination and family planning. This review presents an overview of currently available monoclonal antibodies for the treatment of RMS, including their mechanism of action, efficacy and safety profile. Furthermore, there are practical recommendations for risk management, vaccination, and family planning.

Antibody-based proteins have become an important class of biologic therapeutics, due in large part to the stability, specificity, and adaptability of the antibody framework. Indeed, antibodies not only have the inherent ability to bind both antigens and endogenous immune receptors but also have proven extremely amenable to protein engineering. Thus, several derivatives of the monoclonal antibody format, including bispecific antibodies, antibody-drug conjugates, and antibody fragments, have demonstrated efficacy for treating human disease, particularly in the fields of immunology and oncology. The considerations for the design of antibody-based therapeutics, including immunological context, therapeutic mechanisms, and engineering strategies. First, characteristics of antibodies are introduced, with emphasis on structural domains, functionally important receptors, isotypic and allotypic differences, and modifications such as glycosylation. Then, aspects of therapeutic antibody design are discussed, including identification of antigen-specific variable regions, choice of expression system, use of multispecific formats, and design of antibody derivatives based on fragmentation, oligomerization, or conjugation to other functional moieties. Finally, strategies to enhance antibody function through protein engineering are reviewed while highlighting the impact of fundamental biophysical properties on protein developability.

Ofatumumab is a fully human anti-CD20 monoclonal antibody that can be self-administered by patients and is approved in several countries worldwide for the treatment of relapsing forms of multiple sclerosis (MS). In two identical phase III trials in adults with relapsing forms of MS, subcutaneous ofatumumab was more effective than oral teriflunomide in reducing the annualized relapse rate, as well as reducing MRI-detected lesion activity and limiting worsening of disability. Ofatumumab had a generally manageable tolerability profile; the most common adverse events (AEs) included nasopharyngitis, headache, upper respiratory tract infections and urinary tract infections. AEs of special interest (AESIs) included infections and injection-related reactions, which were generally manageable. There was no apparent association between changes in immunoglobulin G or M levels and the risk of serious infections after 3.5 years of ofatumumab treatment. Thus, ofatumumab is a convenient treatment option that is effective and has a generally manageable tolerability profile in adults with relapsing forms of MS.

The development of effective monoclonal antibodies for the treatment of myeloma has been a long journey of clinical and drug development. Identification of the right target antigen was a critical part of the process. CD38 as a target has been considered for some time, but clinically, daratumumab, a CD38 monoclonal antibody, was the first to be tested, and it has delivered the best clinical responses as a single agent to date. Its proven safety and efficacy in combination



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with other antimyeloma agents have led to several US Food and Drug Administration approvals for treating myeloma. Furthermore, the results of early trials in the induction therapy setting have demonstrated a beneficial role when it is added to the existing induction regimens. This review summarizes the importance of CD38 as a target and examines the clinical development of the CD38 monoclonal antibody daratumumab and its clinical significance in combination regimens in both patients with relapsed/refractory myeloma and patients with newly diagnosed myeloma.

Anetumab ravtansine is an antibody–drug conjugate that targets the tumour differentiation antigen mesothelin. Mesothelin is highly expressed in several malignant diseases, including epitheloid mesotheliomas, pancreatic cancer, biliary adenocarcinomas, gastric and ovarian cancers, and non-small-cell lung cancer.⁵⁹ Because expression of mesothelin in healthy human tissue is restricted to mesothelial cells lining the pleura, peritoneum, and pericardium, this target is attractive for antibody–drug conjugate therapy. Anetumab ravtansine is composed of the human anti-mesothelin monoclonal antibody BAY 86–1903 conjugated to the tubulin inhibitor DM4 by a disulphide linker. It binds to human mesothelin with high affinity and selectivity, thereby inducing efficient antigen internalisation. Findings of preclinical studies of anetumab ravtansine showed potent and selective killing of mesothelin-expressing tumours, with a correlation noted between the amount of mesothelin expression and antitumour activity. Moreover, anetumab ravtansine induced a bystander effect on neighbouring mesothelin-negative tumour cells. In the phase 1 clinical trial,⁶⁰ which included tumour types with known high expression of mesothelin, the maximum tolerated dose was defined as 6.5 mg/kg, administered intravenously every 3 weeks. Dose-limiting toxic effects were keratitis and neuropathy. Preliminary results suggest clinical activity, with partial responses reported in seven (18%) of 38 patients treated at the maximum tolerated dose.⁶⁰ Phase 2 investigations are ongoing in mesothelin-expressing cancers (eg, NCT02610140). Inotuzumab ozogamicin is composed of an anti-CD22 monoclonal antibody attached covalently to calicheamicin, a cytotoxic antibiotic.^{61,62} CD22 is a B-cell lineage-restricted type I transmembrane protein and a member of the SIGLEC (sialic acid-binding immuno globulin-like lectins) family of cell-surface receptors. CD22 interacts with diverse sialic acid-bearing molecules present on various cell types—eg, B cells and T cells, neutrophils, and monocytes—to regulate signal transduction of surface immunoglobulin receptors on B cells, B-cell migration, and maintenance of peripheral B-cell tolerance. CD22 is expressed in most B-lymphoid malignant diseases, including non-Hodgkin lymphoma, chronic lymphocytic leukaemia, and acute lymphocytic leukaemia. Inotuzumab ozogamicin has subnanomolar binding affinity and is internalised rapidly to deliver the calicheamicin payload intracellularly.

Monoclonal antibodies have become a part of daily preparation technologies in many laboratories. Attempts have been made to apply monoclonal antibodies to open a new train of thought for clinical treatments of autoimmune diseases, inflammatory diseases, cancer, and other immune-associated diseases. This paper is a prospective review to anticipate that monoclonal antibody application in the treatment of myocarditis, an inflammatory disease of the heart, could be a novel approach in the future. In order to better understand the current state of the art in monoclonal antibody techniques and advance applications in myocarditis. The developed a systematic elaboration of monoclonal antibodies, pathogenesis of myocarditis, and application of monoclonal antibodies in myocarditis. This paper presents review of the literature of some therapeutic aspects of monoclonal antibodies in myocarditis and dilated



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cardiomyopathy to demonstrate the advance of monoclonal antibody application in myocarditis and a strong anticipation that monoclonal antibody application may supply an effective therapeutic approach to relieve the severity of myocarditis in the future. Under conventional therapy, myocarditis is typically associated with congestive heart failure as a progressive outcome, indicating the need for alternative therapeutic strategies to improve long-term results. Reviewing some therapeutic aspects of monoclonal antibodies in myocarditis, were recently found that monoclonal antibodies with high purity and strong specificity can accurately act on target and achieve definite progress in the treatment of viral myocarditis in rat model and may meet the need above. However, several issues remain. The technology on how to make a higher homologous and weak immunogenic humanized or human source antibody and the treatment mechanism of monoclonal antibodies may provide solutions for these open issues. The further stimulate progress in the area of clinical decision support, must continue to develop and refine our understanding and use of monoclonal antibodies in myocarditis.

Monoclonal antibodies (mAb) are revolutionising the treatment of many different diseases. Given their differing mode of action compared to most conventional chemotherapeutics and small molecule inhibitors, they possess the potential to be independent of common modes of treatment resistance and can typically be combined readily with existing treatments without dose-limiting toxicity. However, treatments with mAb rarely result in cure and so a full understanding of how these reagents work and can be optimised is key for their subsequent improvement. We review how an understanding of the biology of the inhibitory Fc receptor, Fc γ RIIB (CD32B), is leading to the development of improved mAb treatments. Based on pharmacokinetic parameters of monoclonal antibodies, there is a rationale for fixed dosing of these drugs in oncology. Therefore, the fixed dosing is justified and can improve efficiency of the compounding. A new trend has been taking place in the daily oncology practice in the past twenty years are progressively moving toward individualized and personalized treatments. The treatment of breast cancer is one of the best examples to underline the outstanding effectiveness of the individualized approach. The modern molecular pathology features are capable of predicting the biological behavior of the tumors which gives a new basis for our therapeutic choices, both for neoadjuvant and adjuvant settings, as well as for metastatic disease. We review the currently used monoclonal antibodies in the treatment of breast cancer and provide an overview of the new research and future directions in this field.

4. CONCLUSION

Monoclonal antibody-based immunotherapy is now considered to be a main component of cancer therapy, alongside surgery, radiation, and chemotherapy. Monoclonal antibodies possess a diverse set of clinically relevant mechanisms of action. In addition, antibodies can directly target tumor cells while simultaneously promoting the induction of long-lasting anti-tumor immune responses. The multifaceted properties of antibodies as a therapeutic platform have led to the development of new cancer treatment strategies that will have major impacts on cancer care. This review focuses on the known mechanisms of action, current clinical applications for the treatment of cancer, and mechanisms of resistance of monoclonal antibody therapy. The further discuss how monoclonal antibody-based strategies have moved towards enhancing anti-tumor immune responses by targeting immune cells instead of tumor antigens as well as some of the current combination therapies.



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